Design Engineering

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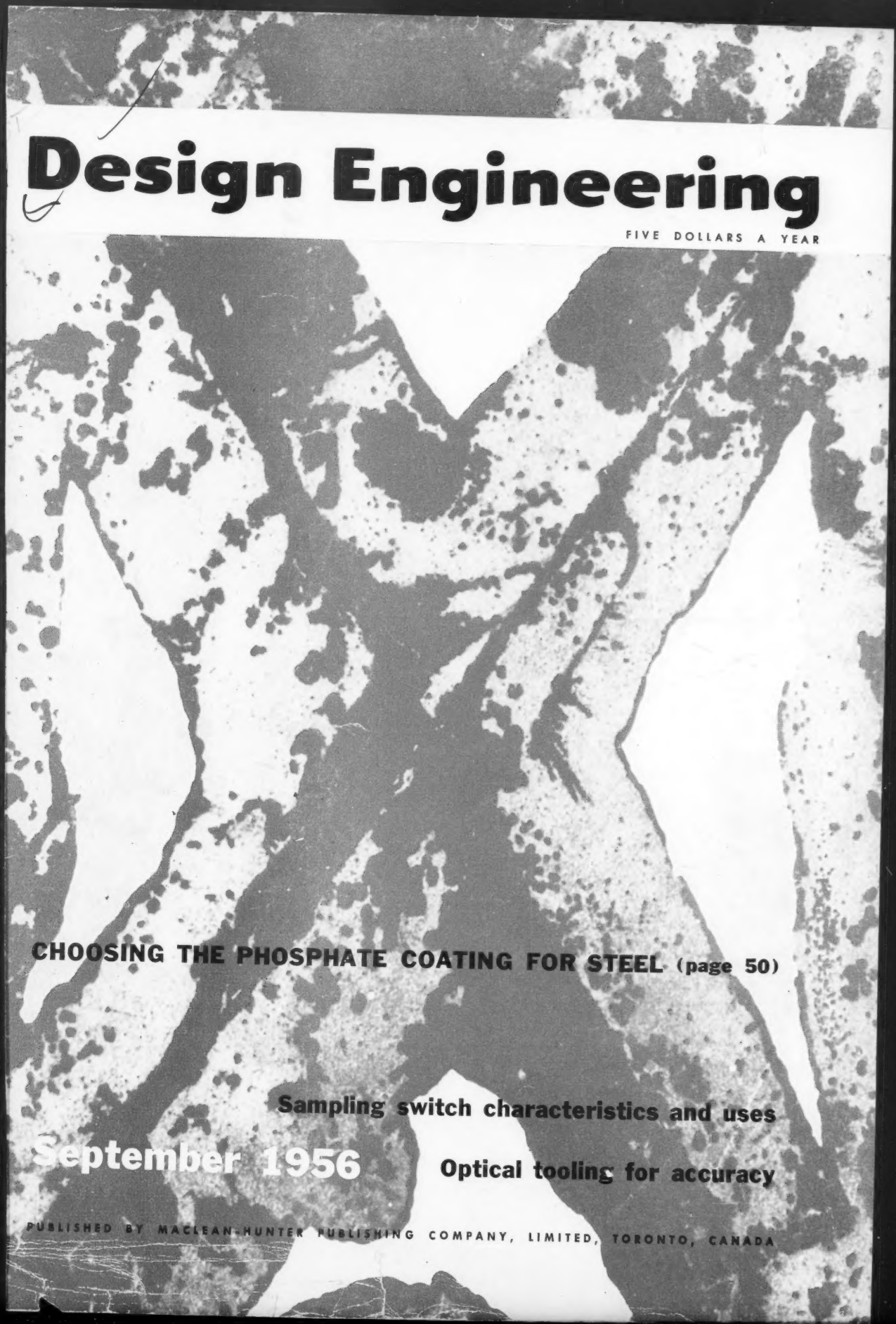


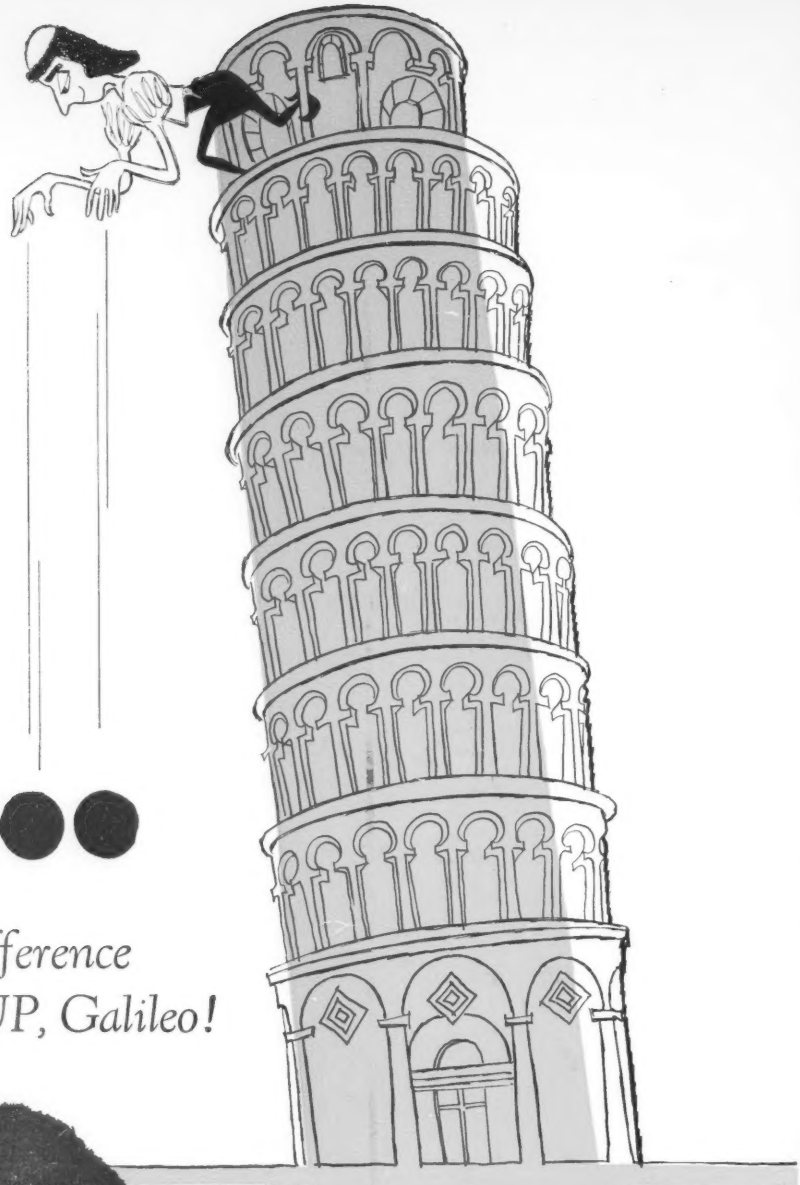
CHOOSING THE PHOSPHATE COATING FOR STEEL (page 50)

Sampling switch characteristics and uses

September 1956

Optical tooling for accuracy

PUBLISHED BY MACLEAN-HUNTER PUBLISHING COMPANY, LIMITED, TORONTO, CANADA



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Design Engineering

VOL. 2 **SEPTEMBER 1956** NO. 9

This month's cover

Gates of Hell? Craters on Vesuvius? Mosquito's-eye view of the porch screen or the morning after the night before? Don Dancer said "I think it's the moon." He's wrong but he should know as he was this month's cover artist. The cover is none of these things and nobody's liver under a microscope. It relates to our feature story on phosphate coatings which starts on page 50. Complete answer to its meaning can be found at the foot of page 53.

Design Engineering

MEMBER

CCAB

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CONTENTS

Features

Short features

Departments

Project | your career in engineering

advanced projects

diversification

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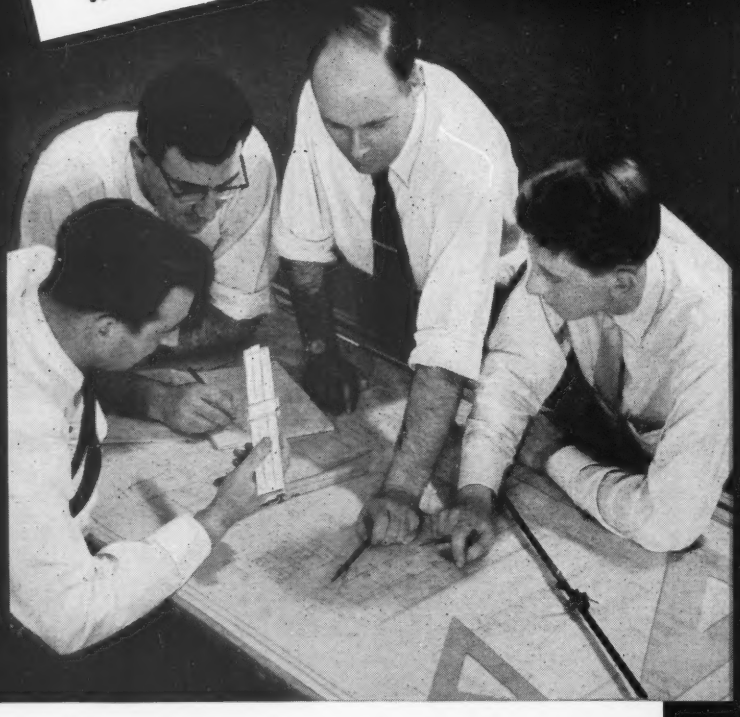

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The **September** issue of **Design Engineering** will carry strong feature articles written by contributors no less experienced than those featured this month.

Feature article in the October issue will deal with circular arcs. This article takes the form of a review of the methods of using circular arcs in place of ellipses. Also featured in the same issue will be articles on the many applications of versatile Neoprene and another on chemical milling. The latter is a newly developed process for handling milling which can't be done by machine.

Inside

Cushman

Rob Cushman is Vice-President in charge of Technical Sales at General Devices Inc. of Princeton, New Jersey. He joined the company in 1954 to manage their sales of high speed motor driven rotary switches. Born a New Yorker, he has wide sales experience in the electronics field and done research on guided missiles and aircraft explosive protective devices—the latter for the National Research Council. A man better qualified to author the article on sampling switches (starts on page 35) would be hard to find.

Jack H. Goodyear, author of our article on phosphate coatings which starts on page 50, is Vice-President and Chief Engineer of the J. W. Rex Company. Goodyear took the first steps to this Vice-Presidency in 1943 when he graduated with a degree in Metallurgical Engineering from Lafayette College. He has worked with Bethlehem Steel, the Naval Research Laboratories in Washington and with Westinghouse. In 1948 he formed Chem-Fin Corporation which, in 1955, merged with the J. W. Rex Co. He is a member of both the American Metals and Electro-platers Societies.

Goodyear

Egy

Third in the string of vice-presidential contributors to **Design Engineering** in September is **W. L. Egy** who combines the position with Director of Sales for the Brunson Instrument Co. of Kansas City. Egy has a long career in optical instruments having been some 30 years Chief Engineer for W. & L. E. Gurney. His article on optical tooling (page 42) is by no means his first journey into print on such subjects. He's a graduate of the University of Illinois and holds a B.Sc. in Electrical Engineering and M.Sc. in Physics.

Reports

News in brief from the world's producers

ST. THOMAS, ONTARIO — A recent announcement by T. M. Green, the general manager of Redmond Manufacturing of Canada, Ltd. was to the effect that the firm has expanded its plant by 25% in order to produce a new type AY induction motor.

This new fractional horsepower, 110V AC. induction motor will be suitable for air conditioning, window fans, refrigeration, direct drive blowers in central heating systems and other applications.

The object of this new production phase is to meet the growing demands, in an expanding Canadian market, of the air conditioning, ventilating, heating, refrigeration and appliance industries.

An additional 3,000 square feet of floor space has been provided at the St. Thomas plant to handle the production of induction motors in a wide range of sizes up to 1/3 horsepower.

According to Green, the present addition is just a beginning. Plans call for continued Redmond expansion and the addition of facilities to build a Canadian market.

In addition to manufacturing fractional horsepower induction electric motors, the firm will continue to produce 6, 12 and 24 volt motors for automobile heating and defrosting systems. More than 1,500,000 of these units have been produced by Redmond since Canadian operations began in 1948.

• • •

A plant of circular design

OAKVILLE, ONT. — Probably the first of its kind on the continent is a polygonal building of 25 sides being built for Canadian Charts and Supplies and the John Wilkes Press in Oakville.

Each of the sides is 16 feet long and the radically designed plant will provide some 13,000 square feet of floor space on one floor with a smaller second floor section at the centre for staff facilities.

Walls will be of concrete block against which earth is banked almost to the roof line. Windows will be installed only 30 deg. from the horizontal and will be just under the roof overhang. The roof itself will be a shallow dome with a ceiling height of between nine and 18 feet. Laminated-wood beams and cantilever design have eliminated most of the steel normally needed in a building of this size.

F. C. D. Wilkes, Jr., president of the company and himself a professional engineer, claims three advantages to a circular layout. It allows for efficient work flow through the production departments, staff and materials can move from point to point in the building with a minimum of travel and service facilities can be concentrated at the centre where they are equally available to all.

• • •

Westinghouse new plant

LONDON, ONTARIO — A new distribution transformer plant, costing between $2 and $3 millions, is to be built by the Canadian Westinghouse Company at London, Ontario. The new plant will be another link in the company's multi-million-dollar expansion and decentralization program.

The move was announced by R. H. Williams, general manager of the firm's industrial products group. The plant will be used for the manufacture of distribution and instrument transformers, power capacitors, lightning arrestors and power fuses.

The new plant will employ some 200 people when peak production is reached. Manufacturing space will include 100,000 sq ft with an additional 12,000 sq ft for offices.

"The establishment of a new plant in London follows our announced policy of decentralization wherever feasible," Mr. Williams stated.

The policy of single-line product decentralization adopted by Canadian Westinghouse has seen manufacturing facilities established at several points distant from Hamilton during the past several years. Major moves have sent the company's lighting and lamp divisions to Granby and Three Rivers, Quebec, respectively, and television-radio manufacturing to Brantford. Television tube assembly was recently switched to Grimsby, Ont., and household meters are now being manufactured at Stoney Creek, Ont. The most recent decentralization step has sent the production of small motors to Stratford, Ont.

The Westinghouse executive stated that this policy is providing all the benefits of straight-line integrated manufacturing and better operating conditions.

Mr. Williams cited increased activity in the growing market for power distribution products as the reason for establishing the modern manufacturing facilities.

"The demand for electric power is apparently insatiable. There is every indication that in the future, whether it be supplied from water or atomic energy sources, it will continue to increase at an even higher rate than it has in the past," he said.

• • •

Search for brain power

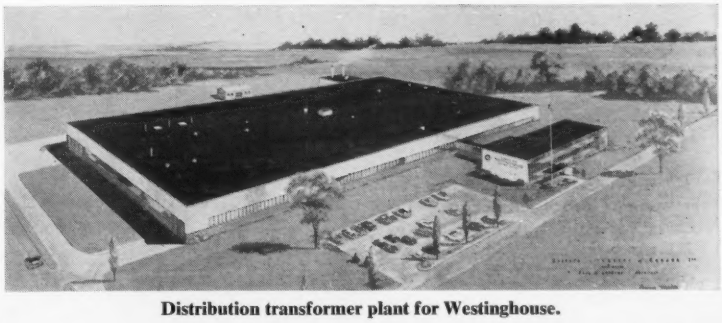
PASADENA, CALIF.—Two Southern California electronic companies have enlisted the aid of television in their continuing search for scientific brain power.

Consolidated Electrodynamics Corporation and Electro Data Corporation are co-sponsoring a non-fictional popular science program in an effort to attract engineers, technicians and draftsmen to their firms.

Called "Adventure . . . Tomorrow," the weekly half-hour show unfolds in lay terms the latest advances of modern science. It is designed to appeal to the non-technical person as well as the engineer.

The opening show featured films of early V-2 rockets captured in Germany and an interview with Dieter Huzel, the man responsible for that historic rocket. Huzel, one of Germany's top rocket designers during World War II, is now with Rocketdyne, a division of North American Aviation.

Other programs will dramatize operation units that intercept and strike down enemy bombers without actually seeing the planes, a slow-motion study of exploding bullets and electronic instruments which sense more than fingers, see more than eyes and move faster than minds.



Distribution transformer plant for Westinghouse.

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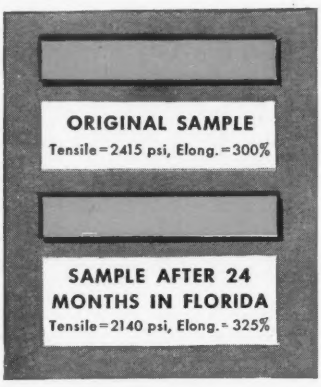


HYPALON® can be compounded in an unlimited range of weather-resistant colors

HYPALON, Du Pont's new synthetic rubber, brings brilliant and varied colors as well as superior performance to the design field. Colored compounds of HYPALON start bright . . . *stay* bright despite severe exposure conditions indoors or outdoors. The samples shown above, for example, were subjected to two years of outdoor exposure. There is virtually no change in color and negligible change in physical properties.

In addition to outstanding color stability, HYPALON has many other advantages that can help your products give *extra-long service* on industry's toughest jobs. Compared to other kinds of rubber, HYPALON shows unusual resistance to hardening at elevated temperatures (250° to 350°F.). It is completely resistant to ozone and has exceptional resistance to strong oxidizing agents.

When your design calls for a resilient material that must have exceptional resistance to these conditions, it will pay you to take a close look at HYPALON.

NEOPRENE air-brake tube still in service after 5,500,000 flexings

No downtime in 4 years

The brake element shown is part of a clutch-and-brake unit which is capable of stopping heavy rotating equipment within 1/10 of a second. One such unit has piled up a record of 5,500,000 engagements in four years *without any maintenance*. The key to this kind of performance lies in the design of the machine and in the use of two rayon-reinforced neoprene tubes.

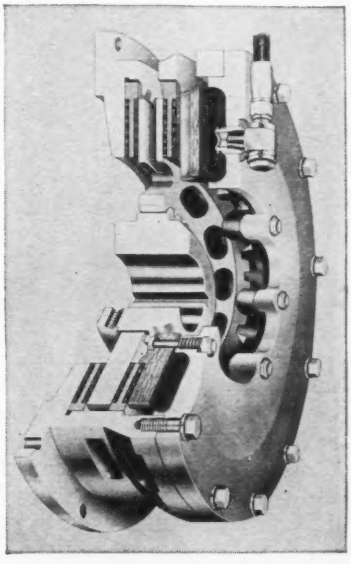
Typically, two of the pictured elements are used together, one serving as the clutch, the other as the brake. When the stop switch is thrown, compressed air is released from the neoprene tube in the clutch element; this disengages friction plates in the clutch and disconnects the drive motor from the driven machine. At the same time, in the brake element, compressed air is admitted to the neoprene tube, engaging friction plates and halting the machine.

Neoprene resists oil, high temperatures

Neoprene's superior oil resistance and durability at high temperatures have made the performance of this clutch and brake possible. Natural rubber tubes previously used were deteriorated by heat and by the oil that almost invariably gets into any compressed-air supply. They swelled, and the inside surfaces tended to become tacky and stick together. When rayon-reinforced neoprene air tubes were used, the problem was solved.

Neoprene makes a better design

In designing new products or improving old ones, neoprene stands up where ordinary resilient materials fail. Neoprene offers the designer resistance to oil, heat, weathering, chemicals and abrasion. It improves product performance—cuts maintenance costs. Complete property data and typical neoprene application data are available.



SECTIONAL VIEW of brake element, with Neoprene air tube in red

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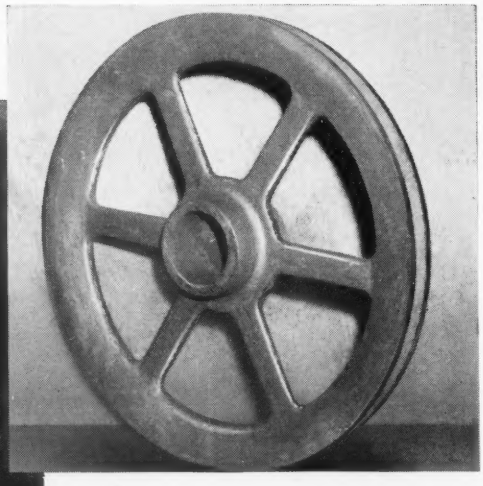
New Design Applications of Ductile Iron based on its Many Advantages

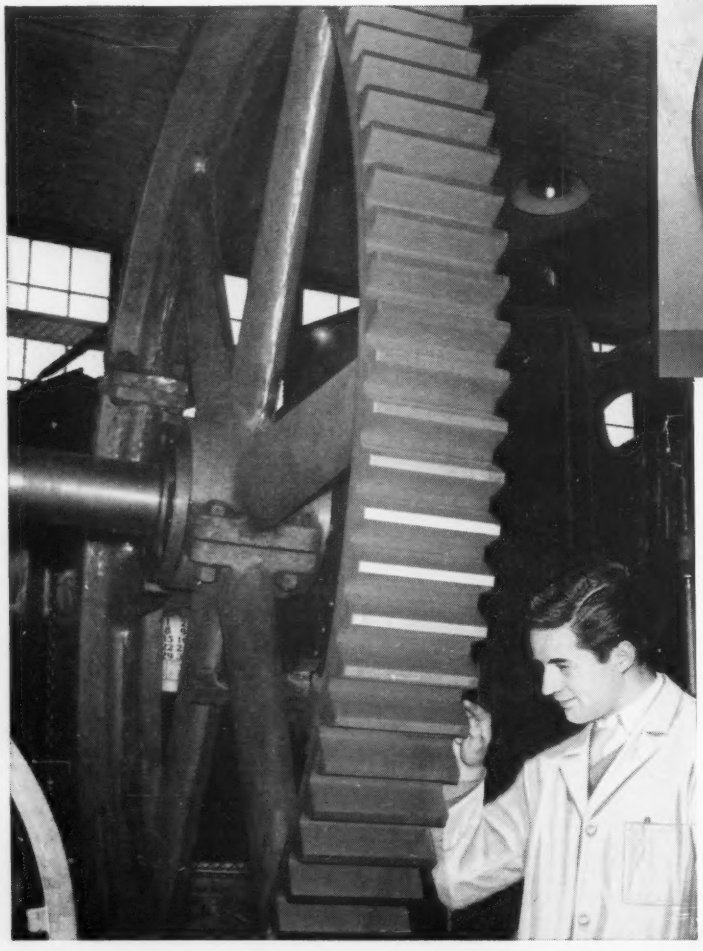
Ductile irons are a group of cast metals which combine the processing advantages of cast iron with many of the engineering advantages of steel. This is a result of a low melting point, good fluidity and castability and high machinability plus a useful combination of strength, toughness, ductility and wear resistance.

Ductile iron permits the production of castings which are intricately shaped or have very light sections and yet must withstand severe service conditions.

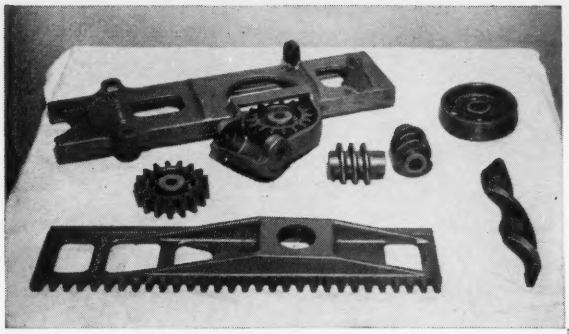
Ductile iron castings are not subject to size limitations. They are produced commercially in weights varying from 2 ounces to 100,000 lbs. with section thickness varying from 0.10″ to 48″.



▲ Wheel of ductile iron 80-60-03 type. Part of the suspension and running gear of the famous Spanish-American Cable Car that spans the gorge at Niagara Falls, Ont. Supplied by Welland Iron & Brass Limited, Welland, Ont.

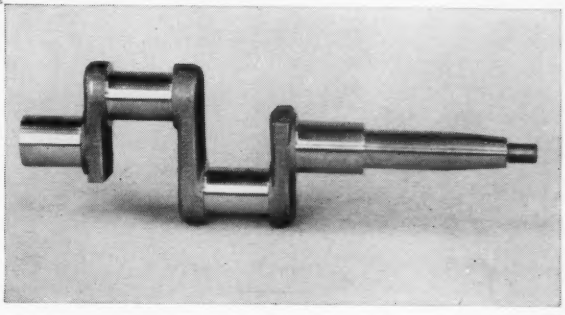


◀ Ductile iron 100″ pitch diameter gear of the 86-60-03 type produced by Letson & Burpee Ltd., Vancouver, B.C.



A good example of the intricate castings possible with ductile iron. These 60-45-10 type were cast by Bell Foundry Co. Ltd., St. James, Manitoba, to be used on a grain swather. Notice flat bar test piece, at right, twisted in ductility test.

A sample of an exacting casting that must be able to absorb shock, possess torsional rigidity, have excellent wear resistance and yet be readily machinable. This ductile iron crankshaft of 80-60-03 type was cast by Canada Iron Foundries, Limited, Special Products Plant, Hamilton, Ont.



Ductile Irons Prove Economy
Both in First and Overall Cost

Ductile iron castings are not expensive even in the first cost. But, more important, parts made of ductile iron have proved, in many cases, extremely economical in overall or ultimate cost. The superior properties of ductile iron have enabled castings to replace more costly forgings or welded structures. Their good machinability has effected important savings in machine shop time and labour. Their resistance to wear, shock or elevated temperature frequently permits their replacement of more costly materials and enables them to perform satisfactorily for a longer time.

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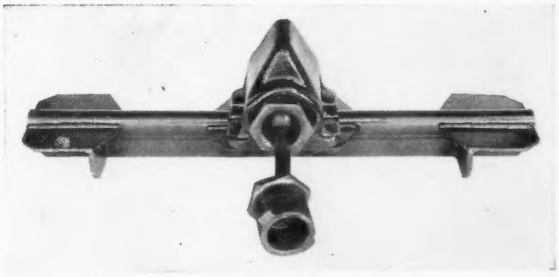

Ductile iron Jungle Trac, a type of equipment which adapts tandem axle trucks to half track for off-the-road service. Parts include adjustable links or "dumbells", and bushings which were cast by Otaco Limited, Orillia, Ontario, in their 60-45-10 Ductalloy.

THE INTERNATIONAL NICKEL COMPANY OF CANADA, LIMITED,
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Please send me a copy of "Ductile Iron—The Cast Iron That Can Be Bent", which illustrates many applications and properties of ductile iron.

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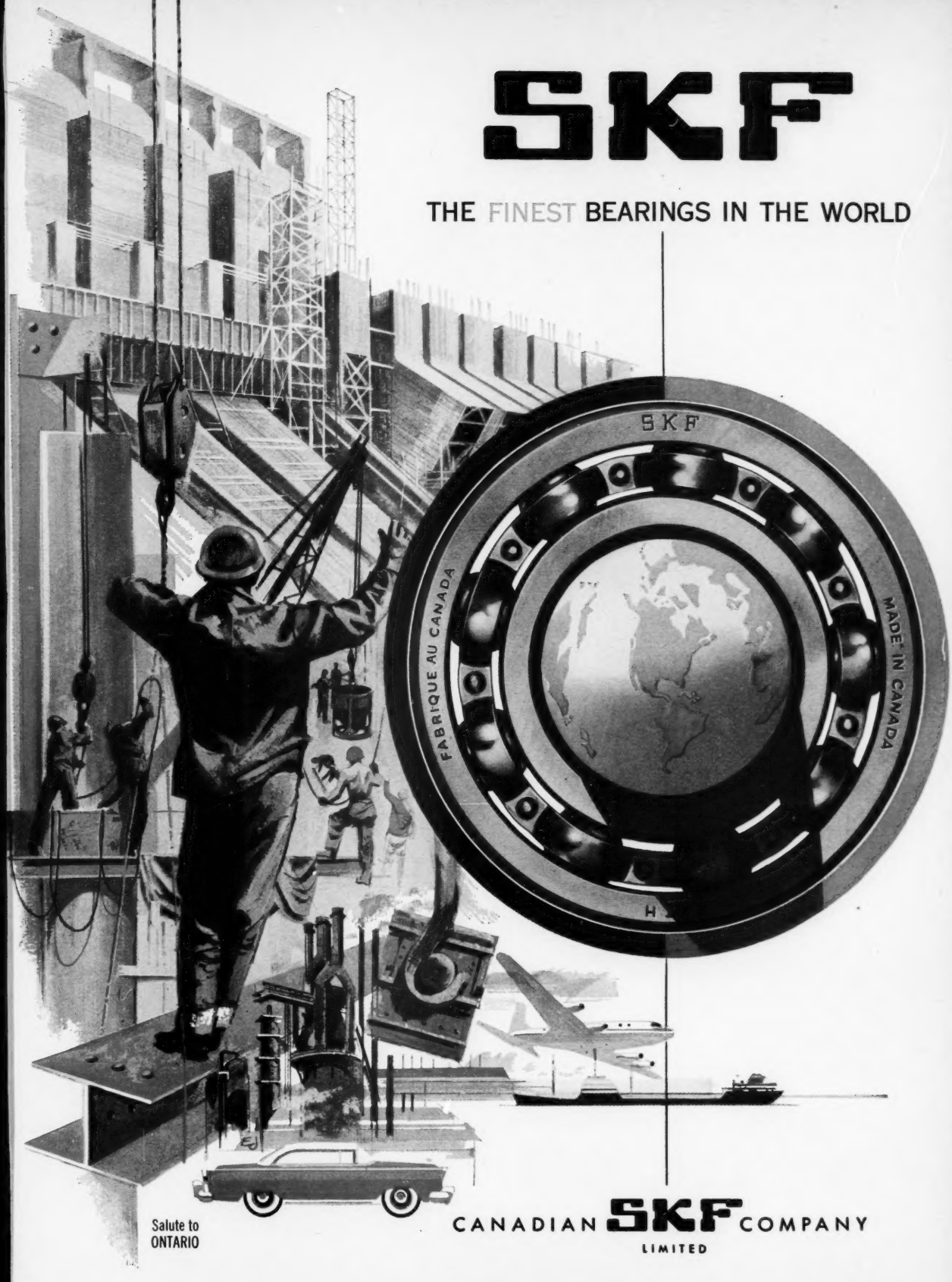

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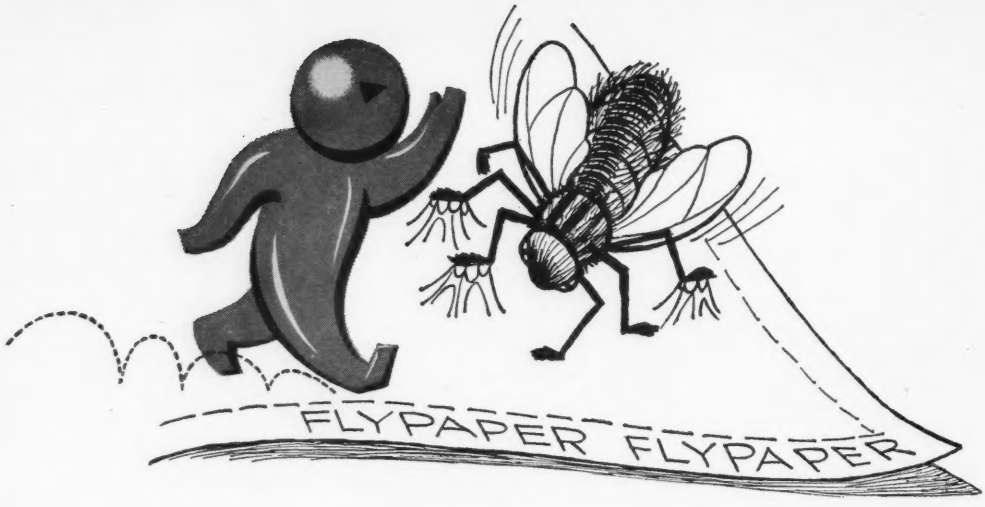

In production work too— G-E Silicones prevent sticking...

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For instance glass molders are using an especially designed G-E Silicone for releasing glass from molds. It gives a better surface finish, eliminates smoke and fumes and improves working conditions. It provides higher bursting strength, better mar resistance, cleaner molds, longer mold life and less maintenance.

Paper treated with G-E Silicone is used as anti-stick or anti-block sheets. It keeps raw rubber slabs, asphalts and resin products and many other materials from sticking together in production and packaging.

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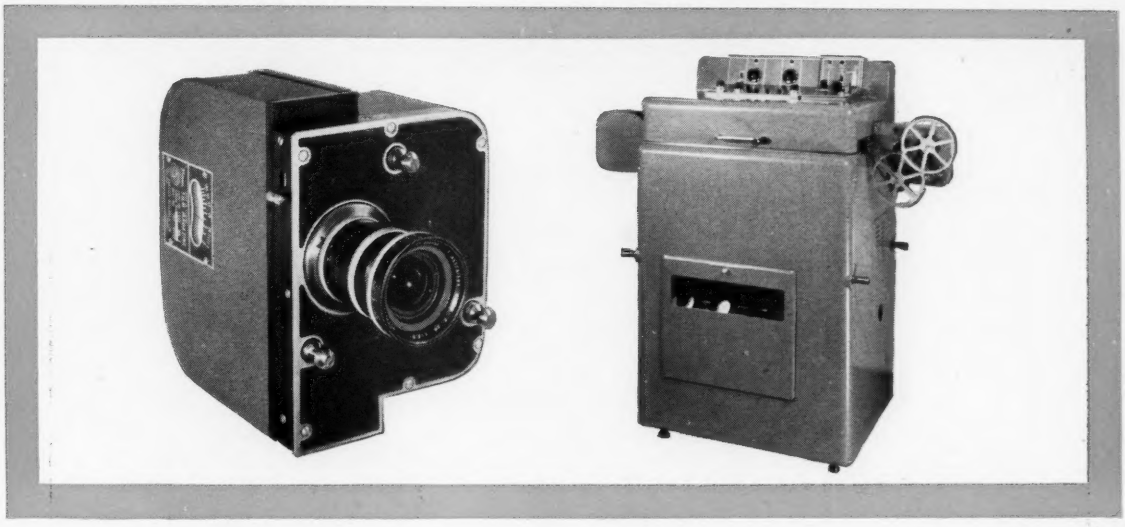

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Size:	7½" x 5⅞" x 6½"
Weight:	13 lbs.
Power:	28 volts DC: constant demand .4 amperes; intermittent up to 1.8 amperes. The Type T232 DC power supply, which operates from 110v 60 cps, is available to power the camera
Lens:	28mm Augenieux F3.5, or to customer specification
Magazine:	100 ft. 35mm standard sprocketed film, No. 10 daylight loading spool. 400 ft. magazine available on special order
Picture Formats:	18x25, 25x25 or 25x36 mm.
Exposure:	1/100 second, or longer with intervalometer control
Interval Time:	3 cycles per second maximum

AUTOMATIC TRI-FILM PROCESSOR TYPE T246 Mk3

Size:	54" long, 22" wide, 51" high
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Temperature-controlled solutions and dryer
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Here is the perfect answer to the problems of film recording and the obtaining of quick results without loss of quality. The Mark 7 Instrumentation Camera is completely flexible through the entire field of instrumentation and aerial survey positioning photography. The shutter is a focal plane type, the basic exposure speed of which is 1/100 second. The camera may be cycled from 3 frames per second to any desired longer interval. Interchangeable apertures permit photographs of 18x25, 25x25 or 25x36 mm. A high degree of accuracy is achieved in respect to lens alignment, focusing and format positioning. Main components designed on the "module" system make conversion from one camera type to another relatively simple should customer requirements change.

A fitting companion is the transportable Mark 3 Automatic Tri-Film Processor that develops and dries 16, 35 or 70 mm film at 1½, 3 or 6 feet a minute. Four 400-ft. 16 mm films can be handled simultaneously—or two 400-ft. 35 mm films—or one 400-ft. 70 mm length. The various film sizes are accommodated by simple adjustments of film separators. Separate temperature control of the processing solutions is possible on each tank from 60 to 110 degrees F, within ± 1 degree. The latest high temperature chemical resistant plastics and Type 316 stainless steel are used in all chemical areas.

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Building custom bearings for industry is a Torrington specialty. Whatever the anti-friction assignment—Torrington can design and build the bearing for the job.

When you specify a Torrington job-designed bearing, you're calling on engineers with extensive experience in custom-bearing applications. Torrington will survey your needs, recommend and design the right bearing to provide peak efficiency, economy and service life.

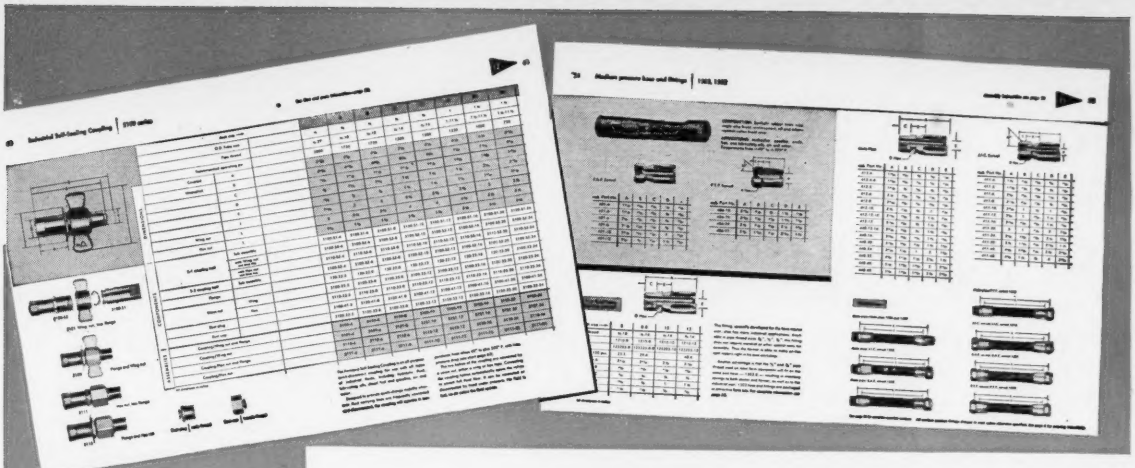
For *any* standard or custom bearing, backed by broad manufacturing and design experience—specify TORRINGTON.

THE TORRINGTON COMPANY, LTD.
925 Millwood Road, Toronto 17, Ont.
District offices and distributors in principal cities of United States and Canada

THE TORRINGTON COMPANY 90th ANNIVERSARY 1866-1956

TORRINGTON BEARINGS

Spherical Roller • Tapered Roller • Cylindrical Roller Needle • Ball • Needle Rollers



Get this Catalog!

For help in fluid line system design . . .

Aeroquip's new 64-page industrial catalog is packed with product information on twenty-six types of high, medium and low pressure hose with reusable fittings, plus adapters and couplings.

You'll find 18 pages of valuable fluid line data to help you in the planning, engineering and installation of fluid line systems on all kinds of industrial equipment.

Aeroquip also offers separate catalogs giving complete information on Aircraft and Marine Hose Lines and Couplings. Fill in and mail the coupon below for your copies.

NO COST TO YOU . . . JUST FILL IN AND MAIL THIS COUPON

Aeroquip (Canada) Ltd., Toronto 15, Ontario

Gentlemen:
Please send me the new, illustrated Aeroquip catalog checked at the right.

- ☐ **Industrial No. 200**
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Title_____

Company_____

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Aeroquip
REG. TRADEMARK

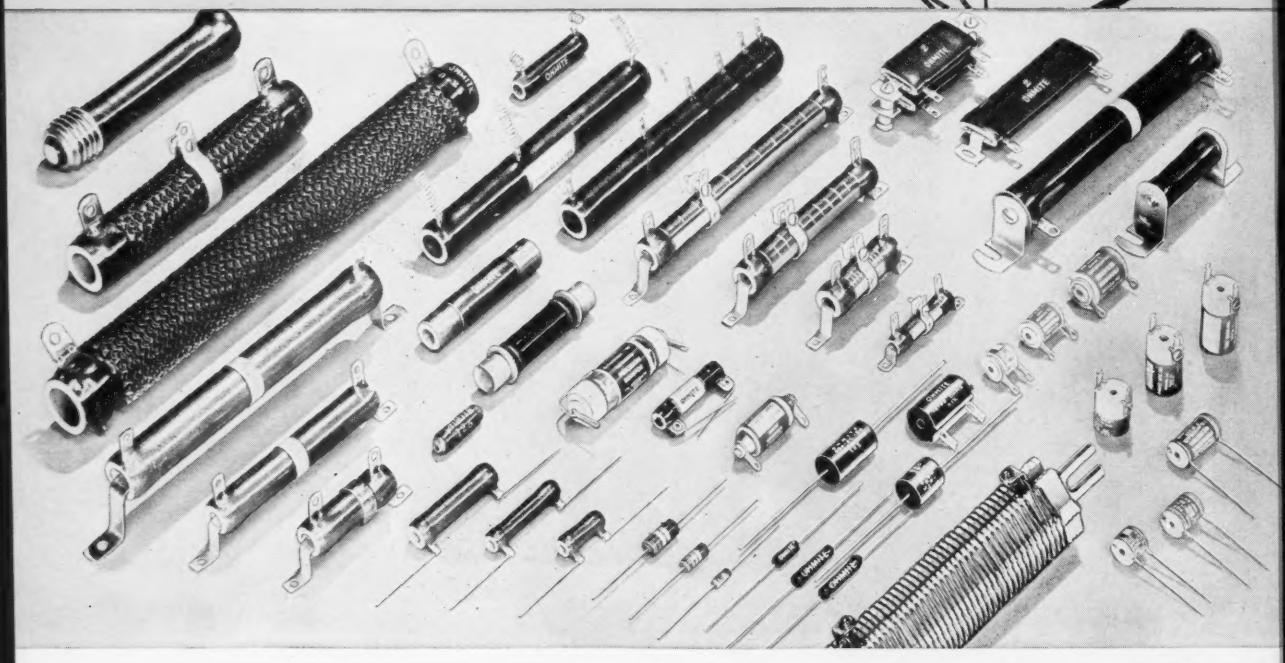
AEROQUIP (CANADA) LTD.
TORONTO 15, ONTARIO, CANADA
LOCAL REPRESENTATIVES IN PRINCIPAL CITIES

AEROQUIP PRODUCTS ARE FULLY PROTECTED BY PATENTS IN U. S. A. AND ABROAD

OHMITE®

has exactly the resistor you need

Ohmite offers the most complete line of wire-wound resistors on the market . . . fixed, adjustable, tapped, non-inductive, and precision resistors in many sizes, types of terminals . . . in a wide range of wattages and resistances.



Industry's most complete line of wire-wound resistors!

The extensive range of Ohmite types and sizes makes possible an almost endless variety of Ohmite resistors to meet each individual need. Ohmite offers resistors in more than 60 sizes—ranging from 2½" diameter by 20" long to ¼" diameter by $\frac{9}{16}$" long—to meet your exact requirements. MANY SIZES ARE CARRIED IN STOCK. These rugged resistors have proved their quality under the toughest operating conditions. Ohmite application engineers will be pleased to help you in selecting the right resistors for your job.

Write on company letterhead for Catalog and Engineering Manual No. 40.

OHMITE MANUFACTURING COMPANY, 3688 Howard Street, Skokie, Illinois (Suburb of Chicago)

Be Right with **OHMITE®**

RHEOSTATS • RESISTORS • RELAYS • TAP SWITCHES

A. C. SIMMONDS & SONS
100 Merton St., Toronto 12

C. M. ROBINSON
189 Market Ave., East, Winnipeg 2

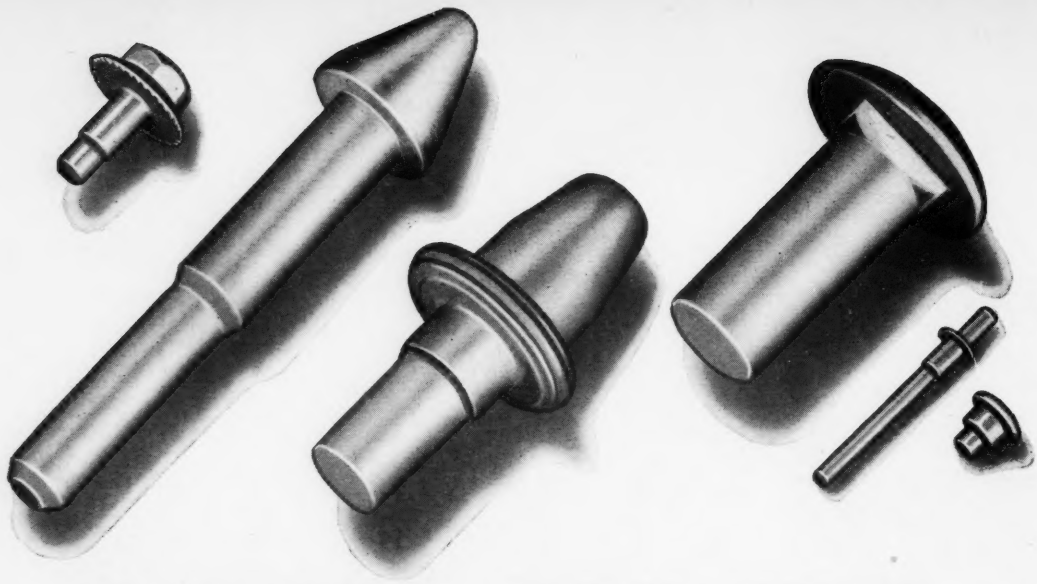
WHAT'S IN A NAME PLATE?

for gear units... you name it, we supply it!

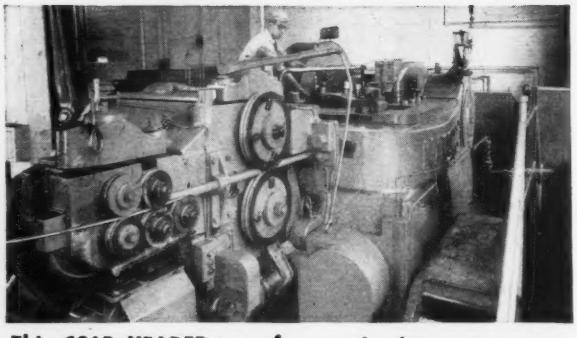
- ANY SIZE
- ANY TYPE
- ANY APPLICATION
- ANY HORSEPOWER
- COMPLETE RANGE OF RATIOS
- STANDARD OR SPECIAL DESIGN

write for gear unit bulletin 368-53G

DOMINION ENGINEERING
COMPANY LIMITED
INDUSTRIAL DIVISION
MONTREAL TORONTO WINNIPEG VANCOUVER



KNOCKED OUT COLD . . .



This COLD HEADER transforms wire into upset parts

BY STELCO

WITH TWO BLOWS

RAPIDLY, CHEAPLY, WITHOUT WASTE!

The economy, speed, and versatility of Stelco's Cold Heading equipment offers wide possibilities for savings in contoured and specially shaped parts.

The examples shown above are ordinary every-day ones . . . yet they show savings in metal costs alone of as much as 63.5% in comparison with similar parts produced by machining. In addition, they are produced by Stelco at rates from 60 to 250 per minute, against a maximum of about 40 per minute for automatic screw machines.

On Stelco's Cold Headers, wire up to 1″ in diameter, of any forgeable metal, can be upset to 4½ times its original diameter, with secondary operations such as threading, punching, shaving, or bending being added if desired.

Stelco Engineers will be glad to advise on the adaptability of cold heading to *your* needs. Address your enquiries to any Stelco Sales Office.

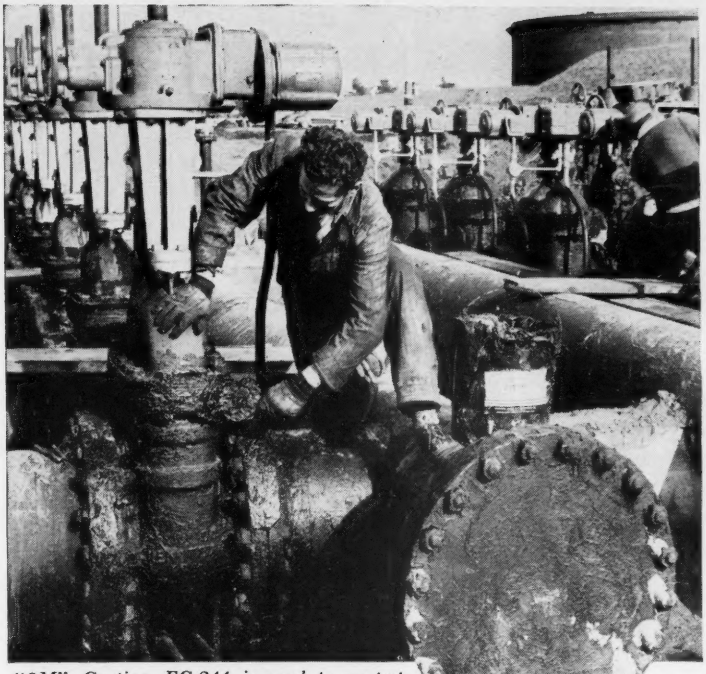
INDUSTRIAL FASTENERS INSTITUTE

55121.8

THE STEEL COMPANY OF CANADA, LIMITED

Executive Offices: Hamilton — Montreal

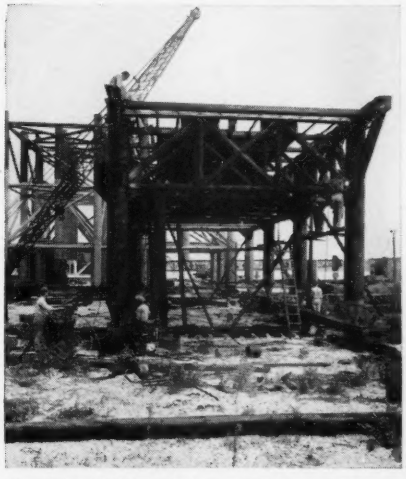
Sales Offices: Halifax, Saint John, Montreal, Ottawa, Toronto, Hamilton, London, Windsor, Winnipeg, Edmonton, Vancouver, J. C. Pratt & Co. Limited, St. John's, Newfoundland



"3M" Coating EC-244 is used to protect underground manifold piping, valves, etc., against soil corrosion.

"3M" Sealers are widely used in the aircraft and automotive industries.

"3M" Adhesive EC-770 being applied to the inside edges of hot air register for bonding a felt strip gasket.



Applying "3M" vinyl protective coating to a part of an offshore drilling rig.

Solving the problems of design /

'3M' offers 1000 different types of adhesives, coatings and sealers

There is virtually no limit to the number of materials that can be joined, coated or sealed with "3M" Brand Adhesives, Coatings and Sealers. Wood, plastics, rubber, glass, leather, metal and many other types of materials, which once were joined with mechanical fasteners, are now being held firmly and permanently with "3M" Brand Adhesives. These same materials can be protected or insulated with "3M" Brand Coatings. Gaps and voids can be closed, metal components separated to avoid galvanic corrosion, by the use of "3M" Brand Sealers. When it's a question of adhesives, coatings or sealers—consult your "3M" representative for complete information.

3M COMPANY **ADHESIVES, COATINGS, SEALERS**

PRODUCTS OF 3M RESEARCH

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Sales Offices: **Halifax • Montreal • Toronto • Winnipeg • Saskatoon • Calgary • Vancouver**

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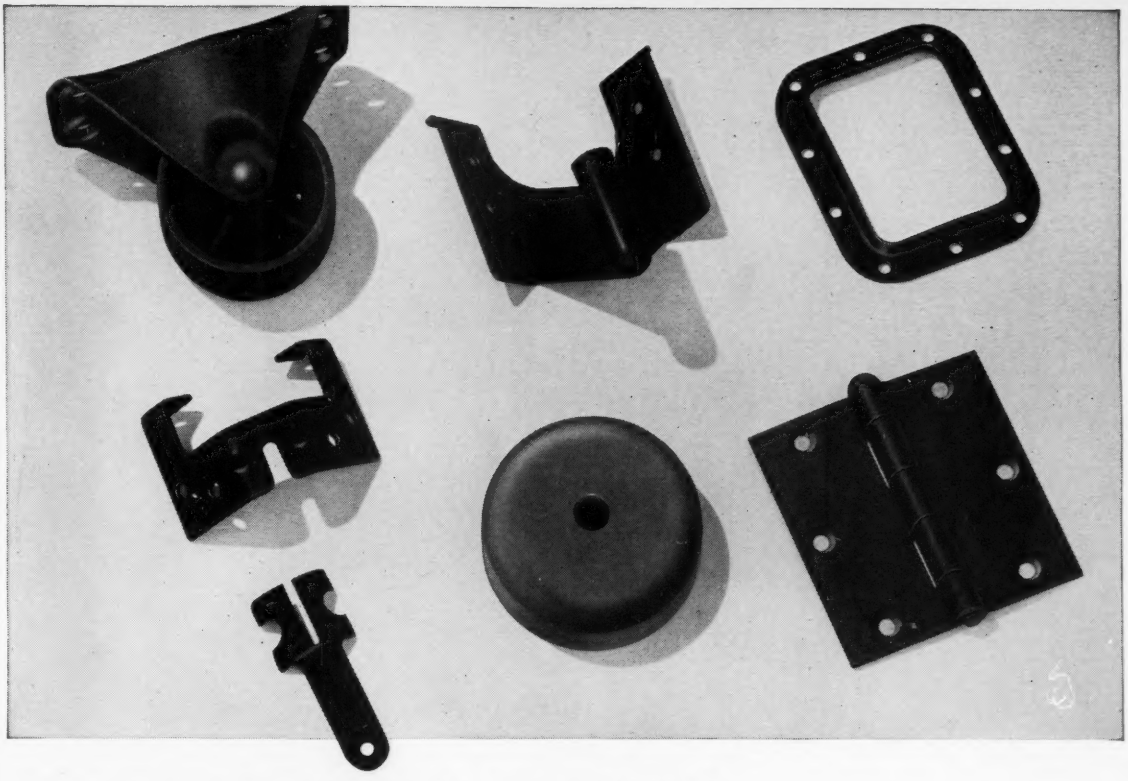
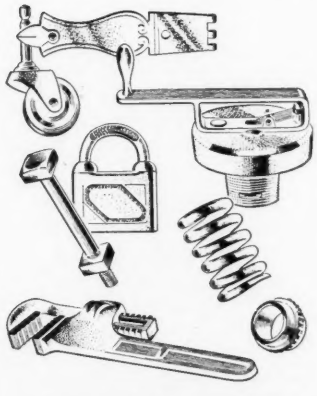


A manufacturer of metal stampings writes:*

"There are many outfits offering something like Parkerizing, but we want the real thing."



Some typical parts which are protected from rust by treatment with Parco Compound

Parco Compound† (Parkerizing†) is the original rust-resistant phosphate coating for iron and steel. For forty-two years it has protected hundreds of different types of products—from bolts to boats.

There are other products "like" Parkerizing, but none quite so effective, so dependable, so thoroughly tested and proven.

Parkerizing is simple, fast, and costs very little. It can be used on any iron or steel article which can be immersed in the tanks. Since it does not change the dimensions of the treated parts, it is excellent for threaded or close-fitting components. Parts treated with Parco Compound may be finished with stains, waxes, oils or paint.

You, too, should demand "the real thing." Use Parkerizing for rust resistance.

**Name on request.*

†Parkerizing, Parco—Reg. U.S. Pat. Off.

PARKER RUST PROOF COMPANY
OF CANADA, LTD.
REXDALE BLVD., REXDALE (TORONTO) ONT.

Since 1914—leader in the field

BONDERITE	BONDERITE and BONDERLUBE	PARCO COMPOUND	PARCO LUBRITE	TROPICAL
corrosion resistant paint base	aids in cold forming of metals	rust resistant	wear resistant for friction surfaces	heavy duty maintenance paints since 1883

Wallace Barnes produces TWO benefits!

Just as every father is proud of his offspring, we're proud of *our* two babies . . . "quality" and "service."

"Service" means that our outstanding laboratory facilities, engineers and technicians are always at *your* side, ready to help *you* with *your* problems . . . and "quality" means Wallace Barnes precision springs assure the good name of your product even under the severest conditions.

"Quality" springs are the only kind Wallace Barnes will ever make . . . or sell.

PICTURE BOOK OF SPRINGS

FREE BOOKLET

Our PICTURE BOOK OF SPRINGS is a photographic reference of the many different types of springs made. This indexed book can save time for busy purchasing agents and engineers . . . completely FREE . . . a letter or penny postcard with your name and address is all that is needed!

WALLACE BARNES CO.LTD.

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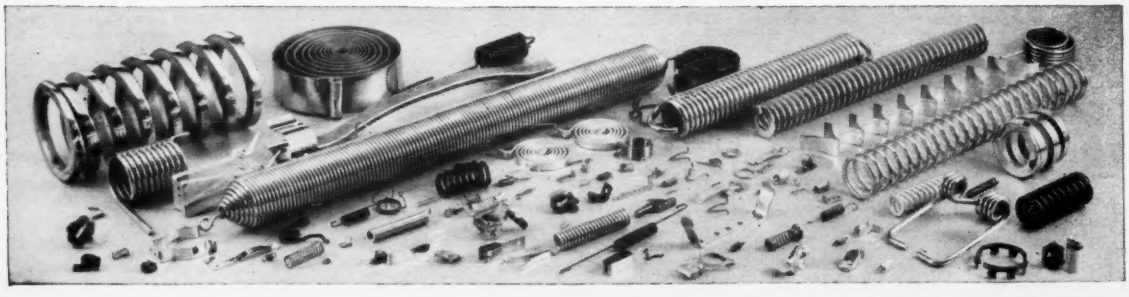
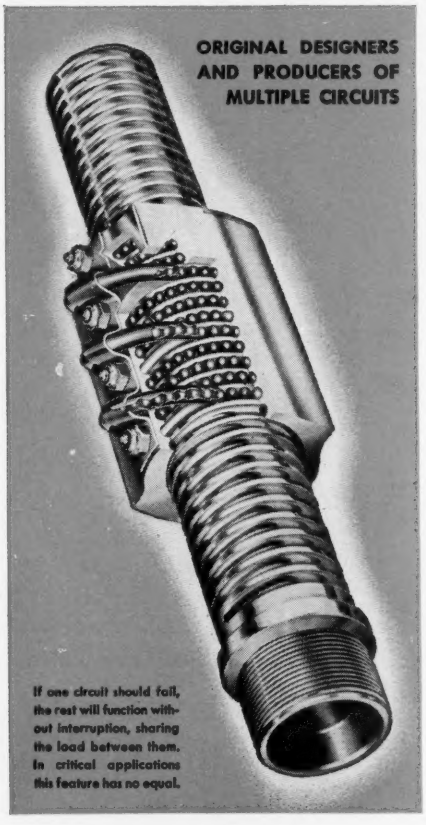


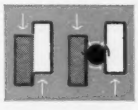
SAGINAW b/b SCREWS are guaranteed

90% EFFICIENT!

Require 2/3 LESS torque than Acme Screws for same linear output on Actuator and Positioner Applications! Saves space, weight!

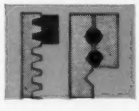


WHAT IT IS AND HOW IT WORKS

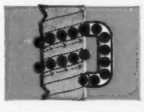


Let's start at the beginning, with the familiar principle that there's far less friction in *rolling* than in *sliding*. By applying this principle,

Like stripes on a barber pole, the balls travel toward end of nut through spiral "tunnel" formed by concave threads in both screw and mating nut.



the *Saginaw ball/bearing Screw* radically increases the efficiency of rotary-to-linear motion (and vice versa). Instead of *sliding*, mating surfaces *glide* on rolling steel balls.



At end of trip, one or more tubular guides lead balls diagonally back across outside of nut to starting point, forming closed circuit through which balls recirculate.

DESIGN ADVANTAGES

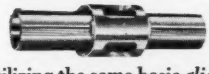
1. Increases efficiency — Acme screw is 15%-20% efficient — b/b screws are 90%-95% efficient.

2. Saves power — requires 2/3 less torque than Acme screws for same linear output.

3. Saves space — permits smaller motors, gear boxes; eliminates pumps, piping, accumulators.

4. Assures positive positioning — permits precision control within thousandths of an inch.

SAGINAW b/b SPLINE



Utilizing the same basic *gliding ball* principle, Saginaw has developed the *Saginaw b/b Spline* which radically increases the efficiency of transmitting or restraining high torque loads.

Averages 40 times lower friction coefficient than sliding splines!

It can be fitted with integral gears, clutch dogs, bearing and sprocket seats, etc., for use with a wide variety of electrical units. AVAILABLE IN ALMOST ANY SIZE. (Units have been engineered as small as ⅜ IN. IN DIAMETER.)

Saginaw ball bearing Screws & Splines

SAGINAW STEERING GEAR DIV., GENERAL MOTORS CORP., SAGINAW, MICH.

SEND COUPON FOR 32-PAGE ENGINEERING DATA BOOK

Saginaw Steering Gear Division, General Motors Corporation
b/b Screw and Spline Operation
Dept. 9W, Saginaw, Michigan
Please send new engineering data book on Saginaw b/b Screws and Splines to:

NAME_____

COMPANY_____ TITLE_____

ADDRESS_____

CITY_____ ZONE_____ PROV._____

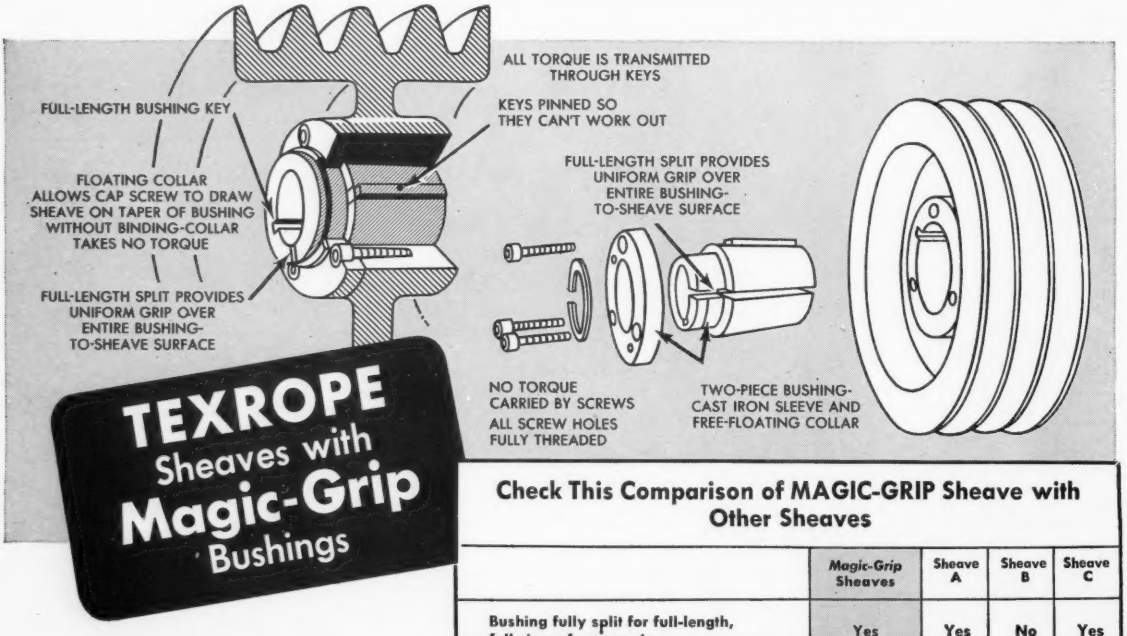
Only MAGIC-GRIP Sheaves Give You These 4 Most-Needed Features

1 Full-length contact between bushing and shaft. Sheave can't get out of alignment or develop excessive run-out because pressure is applied equally all around bushing along full length.

2 Torque between bushing and shaft, and between bushing and sheave is transmitted by keys instead of threaded screws. Thus jamming of screws from shock overloads is eliminated.

3 *Magic-Grip* Sheave installs quickly, easily as a unit instead of in two pieces — simply slip sheave on shaft and tighten screws. Complete sheave can be moved back and forth on shaft to adjust position.

4 Cap screws in *Magic-Grip* Sheaves are full-threaded, engage full thread instead of partial. This ends stripping and jamming problems.



TEXROPE Sheaves with Magic-Grip Bushings

All Allis-Chalmers sheaves are available with *Magic-Grip* bushings. For complete information contact your nearest authorized *Texrope* drive dealer, or CA-C Sales Office or write direct to Canadian Allis-Chalmers Ltd., P.O. Box 37, Montreal, Quebec.

Check This Comparison of MAGIC-GRIP Sheave with Other Sheaves

	Magic-Grip Sheaves	Sheave A	Sheave B	Sheave C
Bushing fully split for full-length, full-circumference grip	Yes	Yes	No	Yes
Torque carried by keys instead of threaded bolts	Yes	No	No	No
All screws engage all threads fully	Yes	Yes	Yes	No
Mounts in one piece	Yes	No	Yes	Yes

MADE IN CANADA

CANADIAN ALLIS-CHALMERS

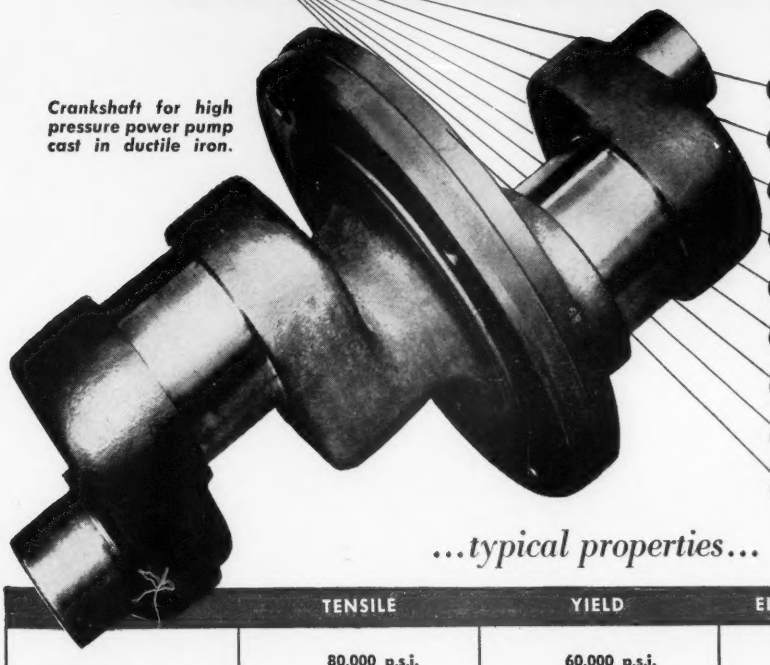
Tex·rope and *Magic-Grip* are Allis-Chalmers trademarks.

85-CAK-1

NODULOY

. . . the ductile iron . . . is being adopted by more and more industrial groups for applications such as:

- PRINTING ROLLS
- GEARS AND WORM WHEELS
- CAST-TO-SHAPE DIES
- CRANKSHAFTS
- FLYWHEELS
- HYDRAULIC RAMS
- MACHINE TOOL CASTINGS
- FARM IMPLEMENT CASTINGS
- RAILROAD EQUIPMENT



Crankshaft for high pressure power pump cast in ductile iron.

. . . typical properties . . .

	TENSILE	YIELD	ELONGATION	BRINELL
AS CAST	80,000 p.s.i. to 100,000 p.s.i.	60,000 p.s.i. to 75,000 p.s.i.	1-3%	225-300
ANNEALED	60,000 p.s.i. to 75,000 p.s.i.	45,000 p.s.i. to 60,000 p.s.i.	10-20%	140-180
HEAT TREATED	80,000 p.s.i. to 160,000 p.s.i.	65,000 p.s.i. to 150,000 p.s.i.	1-15%	160-340

. . . and when to specify it . . .

1. As a replacement for conventional cast iron, where greater strength or resistance to impact is needed.
2. In redesigning, where higher strength results in less weight — hence lower cost.
3. In place of large malleable iron castings which can be difficult and costly to produce.
4. To replace many steel castings, where higher yield strength and better machinability are important.
5. Where heat resistance is a factor, because of Noduloy's resistance to growth.
6. For "wear resistance" applications which may involve chilling, induction or flame hardening of wearing surfaces.

If you have an application for NODULOY or wish to have more information on the subject, write to:

Canada Iron
foundries, limited

Foundry and Machine Division

921 SUN LIFE BLDG., MONTREAL **171 EASTERN AVE., TORONTO**

This hydraulic unit controls air cylinder movement with *21-Jewel Precision*

Compact and self-contained, the Bellows Precision Hydro-Check has automatic flow and thermal regulators built-in

With the Bellows DCP-50A *Precision Hydro-Check* you can make the piston rod of an air cylinder move with clockwork accuracy. Equipped with a DCP-50A an air cylinder can be used to power the most critical tool and work feeding operations . . . because control is virtually 100% uniform.

Hard and soft places in the material being worked do not affect feed rate. Variations in air pressure have no effect on cutting tools. For this Precision unit sets up a perfectly controlled hydraulic "check" that smooths out the natural bounce and chatter of air. Its built-in flow regulator automatically compensates for changes in work load and air line pressure . . . giving the power stroke of an air cylinder a smoothness unmatched even by conventional hydraulic cylinders.

Once the calibrated control knob is set for the feed rate desired it may be locked and forgotten. Resetting is unnecessary. On Monday morning, after an idle weekend, it duplicates Friday's performance. No "warm-up" periods are needed. There is no "drift" as operating temperature rises. The built-in thermal regulator automatically corrects the DCP-50A for changes in oil viscosity.

The Bellows DCP-50A Precision Hydro-Check will effectively check thrust loads up to 3,000 lbs. Easily installed on Bellows Air Motors or conventional air cylinders, it is available in stroke lengths of 2, 4, 6, 9, 12, 15 and 18 inches to meet a wide variety of needs. It can also be furnished as an integral part of the Bellows Air Motor . . . the air cylinder with built-in control valve.

FOR COMPLETE INFORMATION ON BELLOWS HYDRO-CHECKS WRITE DEPT. DE 956

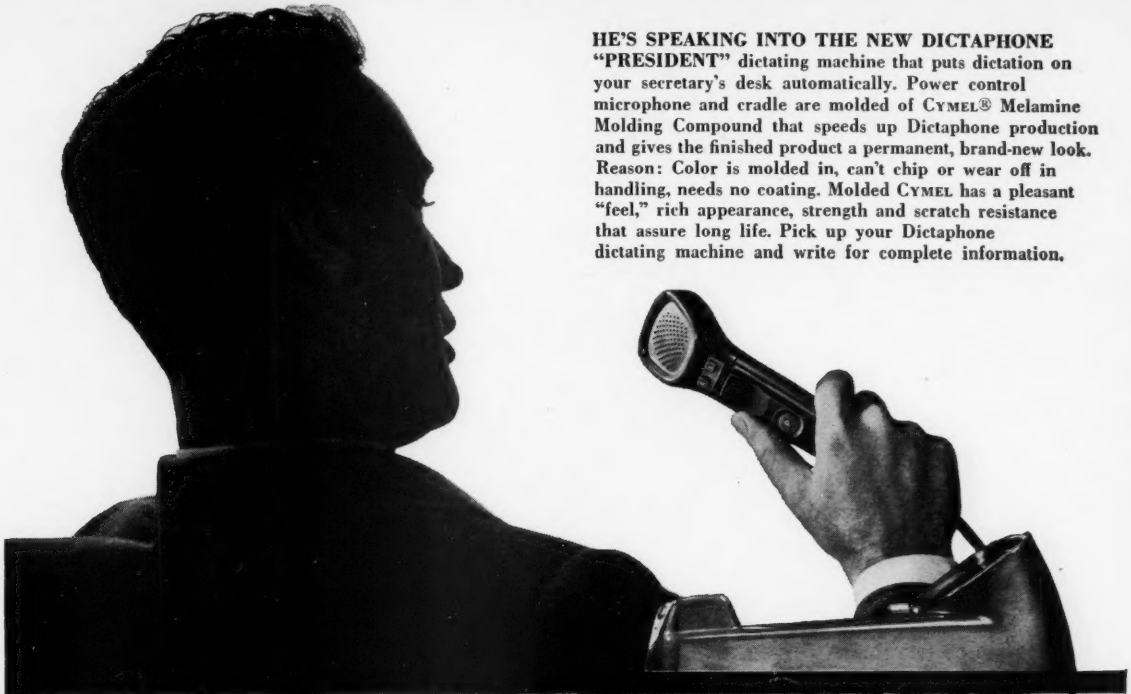
Bellows

Pneumatic Devices of Canada, Ltd.

14 ADVANCE ROAD TORONTO, CANADA

1327A

DICTATED BY PRODUCT IMPROVEMENT:



HE'S SPEAKING INTO THE NEW DICTAPHONE "PRESIDENT" dictating machine that puts dictation on your secretary's desk automatically. Power control microphone and cradle are molded of CYMEL® Melamine Molding Compound that speeds up Dictaphone production and gives the finished product a permanent, brand-new look. Reason: Color is molded in, can't chip or wear off in handling, needs no coating. Molded CYMEL has a pleasant "feel," rich appearance, strength and scratch resistance that assure long life. Pick up your Dictaphone dictating machine and write for complete information.

NEW HEIGHTS IN SAFETY AND STRENGTH: Putnam Rolling Ladder Company utilizes sandwich construction of glass fiber and LAMINAC® Polyester Resin to create lightweight ladders with non-conducting properties that make them ideal for power and electrical work. Their non-corrosive properties and superior strength make them ideal for chemical plants—in fact, they're excellent for any kind of plant under any kind of condition. Consider the advantages of chemical-, abrasion-, impact-, arc- and weather-resistant LAMINAC for *your* product.

NO GLUE FAILURE IN THREE YEARS: White Furniture Company, respected maker of many kinds and styles of fine furniture, uses Cyanamid's URAC® 185 in cold press operations for gluing woods into proper thicknesses for columns, legs and curved portions. Before using URAC 185, various bonding problems were encountered. Since its use, three years ago, *White hasn't had one instance of glue failure!* URAC 185, the glue that *does* hold a square peg in a round hole, is the rotproof, lifetime glue that can eliminate your rejects and complaints.

There's everything to gain in learning how your product or process can use the proved superiority of Cyanamid melamine, urea and methylstyrene molding compounds... polyester resins... resin adhesives... resins for surface coatings. Dictate a letter or give us a call.

IN CANADA:
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CYANAMID

NORTH AMERICAN CYANAMID LIMITED
PLASTICS AND RESINS DIVISION
160 BLOOR STREET EAST, TORONTO 5, ONTARIO

Designed to meet rigid Government specified drop-test

C-G-E DESIGNED AMMUNITION BOX SOLVES PROBLEM

Re-use Feature Saves Money for RCAF...

This unique ammunition box below is just another example of G-E Polyester Moldings at work . . . solving problems and saving money. This moisture-proof, explosives container can be stored outside...can be opened regularly for inspection and *re-sealed* with no adverse effect. The container is lightweight, easy to handle, strong, durable, and proved superior to other materials. RCAF ordnance was handicapped by the lack of these advantages in previous containers.

The applications of G-E Polyester Moldings are many and varied. Every day new uses are discovered for this versatile plastic, uses that create new products and new markets. For instance—Polyester Moldings could be used in a wide range of products, from lawn furniture to luggage, from safety helmets to wheelbarrows. Polyester Moldings resist chemical action and are available in every colour of the rainbow.

Perhaps such versatility could give your product a helping hand. Many times low-cost Polyester Resins have added new life to an old product, have duplicated the favourable characteristics of materials formerly used at worthwhile cost savings.

For further information—contact the Plastic Advisory Service, Canadian General Electric Company Limited, Cobourg, Ontario.

pac

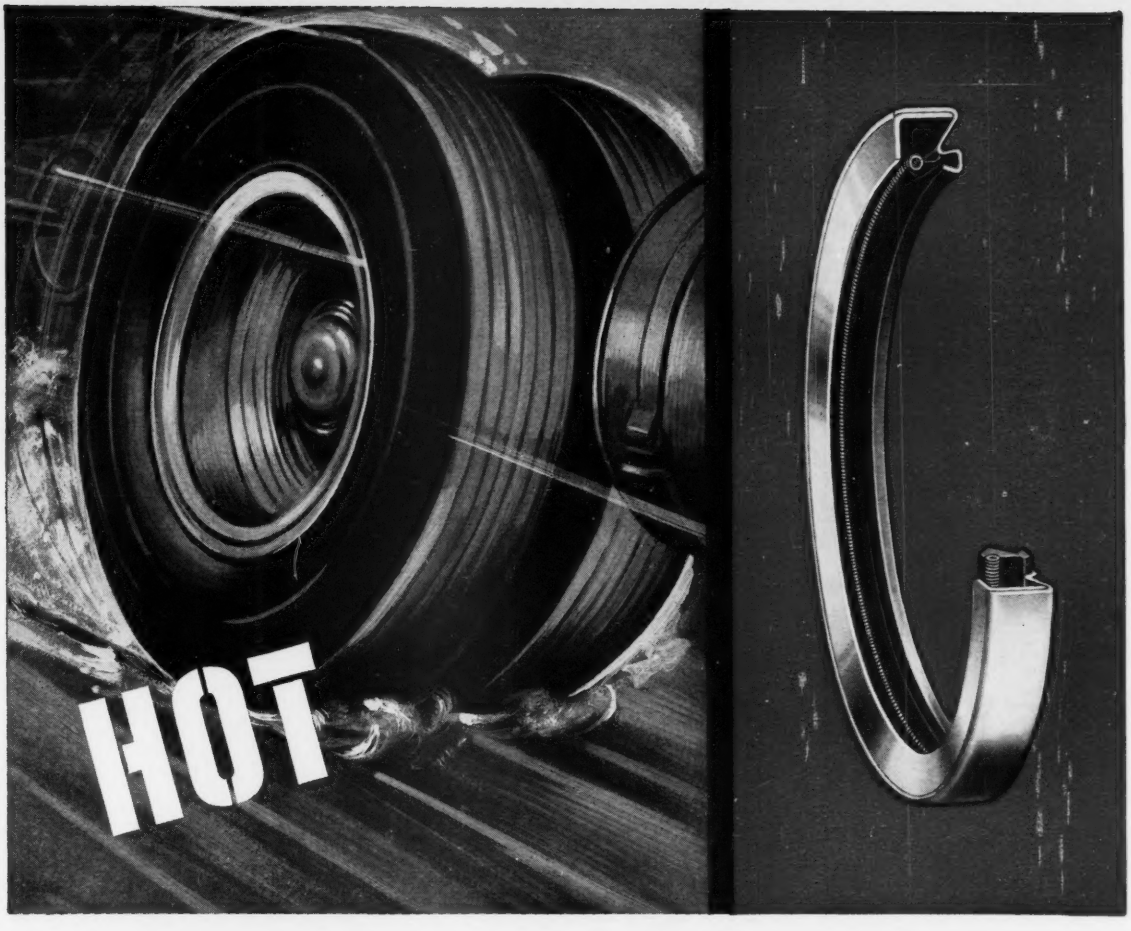
CUSTOM MOLDED PLASTICS

Wins Industry Awards!

This Ammunition Box won First Award in its Division in the 1956 Canadian Plastics Achievements Competition and won top honours in the 1956 Canadian Industrial Container Competition sponsored by Packaging Association of Canada.

451W-256

CANADIAN GENERAL ELECTRIC COMPANY LIMITED



Braking big wheels won't burn

SIRVENE H-T OIL Seals

Now generally available, C/R's new sealing material resists temperatures up to 350° F.

Why the heat's on—Bigger engines, higher speeds, faster deceleration . . . these factors have pushed up temperatures in brake drums, axles, pinions and transmissions. Burn-out of oil seals has become a costly problem. With miles per year jumping to 120,000 and more, maintenance men know that standard oil seals can't take the heat, won't go the distance required on today's high-mileage fleets.

C/R research solves it—Sirvene HT Oil Seals are available in a series of high temperature synthetic rubber compounds developed from special polymers for exceptionally hot applications. They seal effectively at temperatures up to 350° F. With a longer service life than any previously known heat-resistant sealing material, Sirvene HT Oil Seals mean big savings for operators of trucks, buses, tractors, road machinery, automobiles and aircraft.

C/R

PERFECT Oil Seals

SUPER OIL SEAL MFG. CO., LIMITED
HAMILTON, ONTARIO
IN THE U.S.A., CHICAGO RAWHIDE MANUFACTURING COMPANY, CHICAGO 22, ILLINOIS

MADE IN CANADA

Other **C/R** *Products*

SIRVENE: (Synthetic Rubber) diaphragms, boots, gaskets and similar parts for critical operating conditions • Rawhide hammers and mallets

(Courtesy MacCraft Industries Ltd., Sarnia)

TOUGHENED FOR A TOUGH LIFE...
BY **C-I-L FINISHES**

These moulded plywood chair seats and backs, made by MacCraft Industries Ltd., lead a tough life, to equip them for rugged service. MacCraft uses C-I-L 4021-1 Pale Cilux Rubbing and Polishing Varnish. Scuffproof, protective, good-looking, this durable finish actually toughens the chair-units, and increases the length of their life.

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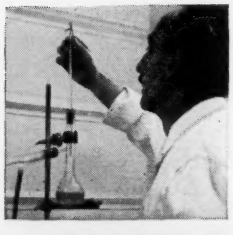

Spraying chair units at the MacCraft plant in Sarnia, Ont.

For Technical Information Bulletin No. 76 — 4021-1 Pale Cilux Rubbing and Polishing Varnish write: Canadian Industries Limited, Paints Division, Dept. 405. Box 10, Montreal, Que.

industrial finishes

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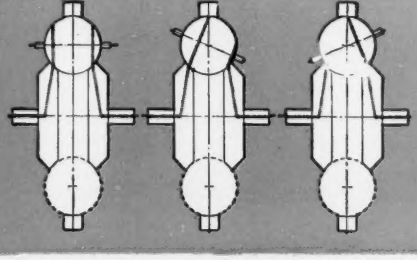
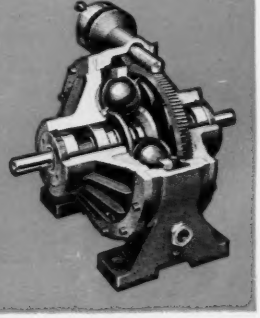
HOW THE CLEVELAND SPEED VARIATOR WORKS



Power is transmitted from input shaft to output shaft through alloy steel driving balls which are in pressure contact with discs attached to the two shafts.

Relative speeds of the shafts are adjusted by changing the positioning of axles on which the balls rotate (see diagrams, left, and cutaway view, right).



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Now available to major producers of heavy-duty air moving equipment: an important new Torrington line of complete blower units for domestic heating, central air-conditioning and other high-capacity cooling. The new units are available in these sizes:

9½" x 9½"	10⅝" x 8"
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10⅝" x 10⅝"	12⅝" x 9½"

Many advanced construction features are incorporated in all units. In addition, Torrington introduces an entirely new principle of blower wheel construction:

The center disc is dovetailed under pressure into the encircling blades. As a result, the interlocking joint tightens under centrifugal force, thus eliminating blade rattle and angle warp at high speeds.

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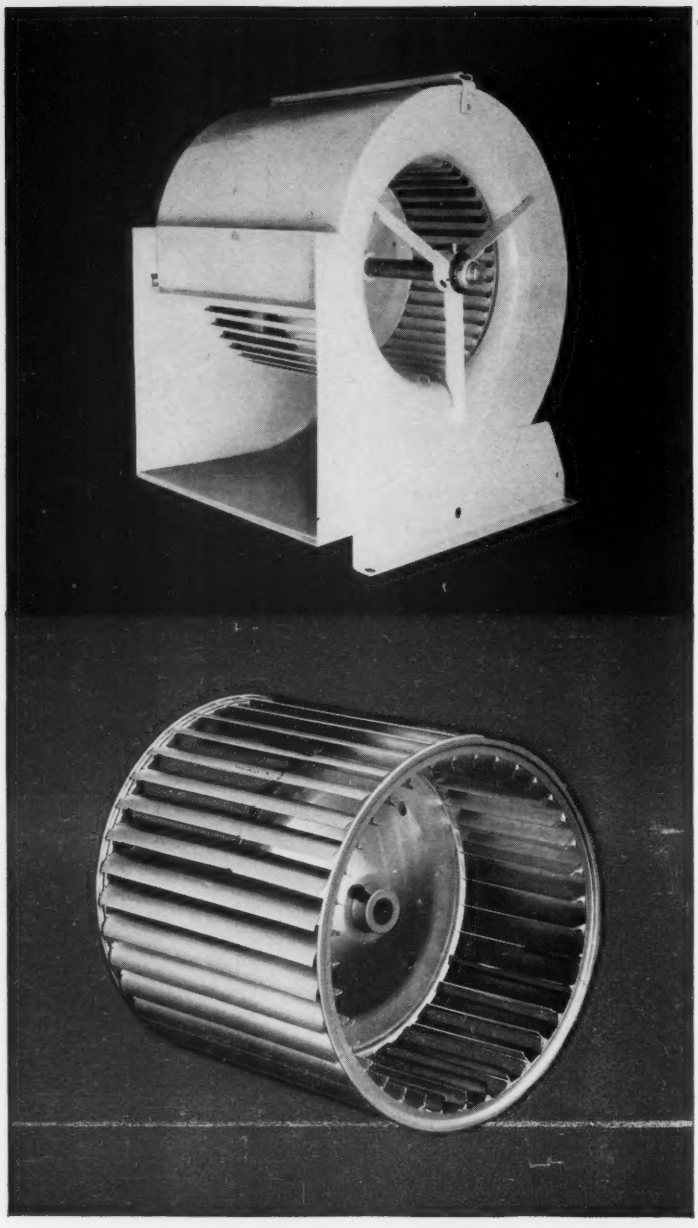
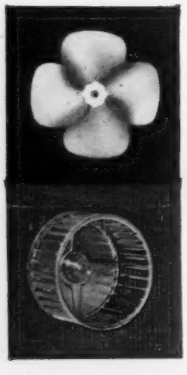
Quite a breeze!...Your inquiries are invited.





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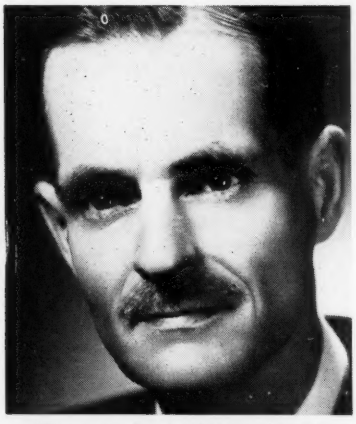
People

Important people who are in the news

On June 5 the Dominion Council of Professional Engineers elected its president at the annual meeting in Saskatoon. Elected to the presidency of the 32,000-member Council, which represents the engineering associations of all provinces, was 53-year-old **Edward J. Durnin, P.Eng.,** of Regina.

Mr. Durnin's birthplace was Dauphin in Manitoba though his public and high school education took place in Saskatchewan at Melfort. He received a Bachelor of Arts degree from the University of Saskatchewan in 1924 and later returned to the province of his birth where he qualified for his degree as a Bachelor of Applied Science in Electrical Engineering at the University of Manitoba in 1928. From 1924 to 1927 he had been



The man the engineers elected

active on forestry patrol operations as a Pilot Officer with the RCAF.

On leaving the University of Manitoba Mr. Durnin joined Canadian Westinghouse in Hamilton, Ontario, and on graduating from the company's engineers training course in 1930 he went with the Saskatchewan Power Commission—an association which, with the exception of the war years, stretches unbroken up to the present. His career with the commission is traced as follows: assistant engineer, Regina; district superintendent, Saskatoon; assistant superintendent, Saskatoon power plant; commercial superintendent, Regina; and finally his present post with the commission which is that of engineer in charge of construction, transmission, distribution and substations.

Logically enough, Mr. Durnin's war service was with the Corps of Royal Canadian Engineers and he cast off his major's uniform in 1945 after overseas service in the United Kingdom and Europe.

He has been married for 25 years and he and his wife Edith have two children. Barbara is a graduate nurse at the Toronto General Hospital and son William carries on the engineering tradition as a student on the mining side at McGill University.

Edward J. Durnin has been a member of the Engineering Institute of Canada since 1930 (served on Council 1949-1950) and a Registered Professional Engineer (Saskatchewan) since 1936. He is the current president of the Association of Professional Engineers of Saskatchewan and is active in the Canadian Electrical Association. Under clubs and societies Mr. Durnin lists the United Services Institute, Military Engineers Association, Canadian Legion, Emulation Lodge and A.F. and A.M.

Hobbies? Gardening, woodworking and an active interest in the welfare of diabetics through the Canadian Diabetic Association.

• • •

Word of three important appointments within their organization comes from General Motors Diesel at London, Ontario. Messrs. **A. G. Shugg, N.D. Love** and **G. M. Lynch** are those with new appointments.

Mr. Shugg has been appointed District Manager in Vancouver for Diesel Engineering Sales. He had been district Engineer in Calgary for Locomotives since early in 1954. Until that time, he had been Service Repair Engineer in London. Shugg was born in Kelowna, B.C. He attended school there and obtained his Mechanical Engineering degree at the University of British Columbia in 1950 after serving in the RCAF from 1941 to 1946.

District Manager Shugg's territory covers an area from Vancouver east to Winnipeg.

Mr. Love has been appointed Engine Distribution Manager at London for Engine Sales. He had been District Manager at Winnipeg since 1953. He joined General Motors of Canada, Oshawa, in July 1939 in the Electrical Maintenance Department. During the war, he worked in the Twin Gun Mount Division and Experimental Engineering Division at Oshawa. From 1945 to 1949 he attended General Motors Institute, Flint, Michigan, receiving a Bachelor of Mechanical Engineering degree in 1950.

During 1950-51 Manager Love was in the Engineering Department at Oshawa. He joined Diesel Sales at Oshawa in 1951, moving to London with the Division in 1952. He is married and has two children.

Mr. Lynch has been appointed District Service Engineer for the vast territory from British Columbia to the Manitoba-Ontario border.

He has more than 25 years of service with his company, having started with General Motors of Canada in Oshawa in April, 1930. In 1939, he went to Regina, Sask. and served in several capacities there, becoming District Service Manager in 1941 and Parts and Accessories Representative in 1947. In 1951 he was appointed District Manager for Alberta territory in the Diesel Sales Division. In his new capacity he still calls Edmonton his home town.

District Engineer Lynch attended elementary school at Westbourne, Manitoba, and secondary school at Wesley College, Winnipeg. He is married and has one son.

• • •

Newly appointed to the vice-presidency of Bakelite Company, Division of Union Carbide Canada Ltd., Belleville, Ontario, is **Philip O. Jeffrey.**

A graduate in chemical engineering from the University of Toronto in 1936, Vice-President Jeffrey crossed to Europe for post-graduate studies which he carried out at the Technische Hochschule

Jeffrey—Bakelite's new V-P

in Berlin. From these studies he went to the Bakelite organization where he has served in several capacities—Assistant Factory Manager, Assistant Sales Manager and Assistant to the President among them.

Bakelites new vice-president is active in the work of the Society of the Plastics Industry (Canada) of which he is currently councilor-at-large.

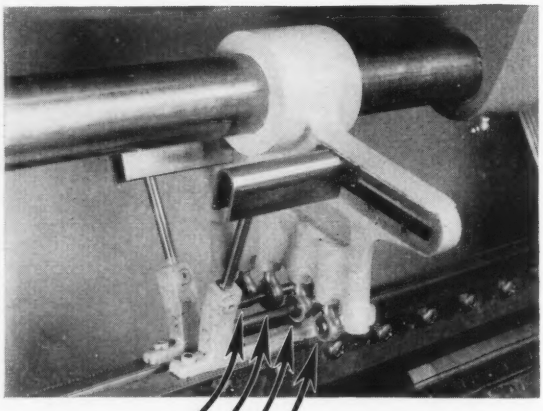
THE SURPRISINGLY VERSATILE

HEIM Unibal

Suspension Hangers ... right out of stock!

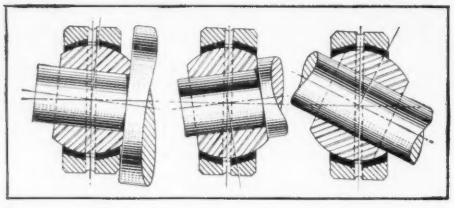
HAS MANY USES OTHER THAN STRICTLY ROD END APPLICATIONS

Because of the very name of the piece, we think of a "rod end" as a sort of universal joint at the end of a rod when used in a linkage mechanism for pull-push operation. And for transmitting motion at varying angles, the Heim Unibal Rod End is the most dependable and most efficient of all.



However . . .

the ability of the Heim Unibal to correct misalignment in any direction, the smoothness of its oscillation, and its low cost, are just the qualities looked for in some unusual shaft supports.



HEIM MALE ROD END

Take this Kidde Knitter as an example of how Heim Unibal Rod Ends have been used as suspension hangers for the guide bars. It is essential that these bars move laterally, both smoothly and freely.

The hanger arm is drilled and tapped, and the male Heim Rod End is screwed into place. Assembly is simple, yet alignment of the bars is positive, and vertical adjustments can be made quickly and easily.

Perhaps you have a place where Heim Rod Ends can improve mechanical function and cut the cost of parts and assembly. Submit your problem to the HEIM engineering department for advice and assistance.

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FACTORY REPRESENTATIVES AND DISTRIBUTORS FOR CANADA

Design Engineering

Sampling switches now offer more

The versatile sampling switch now offers a new high in speed with reliability. Less space and maintenance come as an extra dividend

By Rob Cushman GENERAL DEVICES INC.

The basic sampling switch, in its most common form, consists of a stationary plate containing a circular row of contacts, a concentric collector ring and a rotor containing two brushes (or wipers). One brush sequentially touches each contact in turn as the rotor revolves. This brush is directly connected to the second brush, which continuously rides on the collector ring. Thus, the collector ring is connected in series through the two brushes to each of the contacts in turn. This is a single-pole sampling switch in its simplest form.

Before reviewing specific time-sharing applications, it is interesting to consider the controlling characteristics of high speed switches.

High speed switch designers are concerned with dynamic characteristics such as phasing, make-and-break characteristics, accuracy and the relative duration of ON and OFF times, brush wear, contact resistance and its variation, driving torque, sampling rate and so forth.

Close tolerances, precision ball bearings and generally precise techniques afford a reasonable likeness to watch-making in complexity. These requirements are considerably different from those required for conventional hand-operated switches.

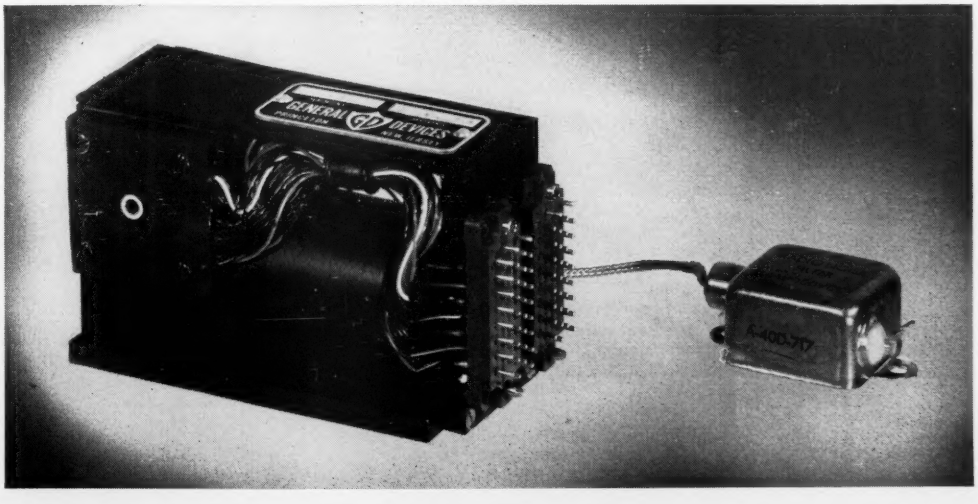
The variation in design of the sampling switch is practically unlimited. Available designs afford switches with 8 or more poles with 200 or more contacts per pole, each with many different types of drive source and packaging.

With the advent of semi-molded contact plate construction and constant force Perma Brush Wipers, the period of service-free life has steadily advanced, so that 500 hours or more are often the specified minimum.

A total life (or life with service) of many thousands of hours is practical, thanks to simplified techniques. Current designs allow field replacement in a few minutes of all the brushes in multi-pole switches without requiring wiper force or phasing adjustments, as has been necessary in the past.

The latest semi-molded contact plate construction technique begins with a standard contact plate in which contact pins are pressed or screwed into precision jig located holes. After all the leads are attached, the plate is molded with specially selected high temperature molding materials. Finally, the contact pins are finished in order to provide a polished, truly flat surface. This molding process

A typical two-pole thirty-channel dc switch of medium life particularly well suited to missile projects.



locks each contact pin into permanent and precise alignment after all the soldering has been done. This is a distinct advantage over earlier construction techniques, where it was necessary to make connections by soldering to the back of the contact pins with considerable danger of expansion and contraction causing permanent distortion or loosening of a contact pin. This, of course, invariably upsets the flatness of the contact pin circle and hence affords markedly increased brush wear and shorter life.

The constant force wiper design ensures such slight wear of the contact pins that resurfacing of the contact plate is normally not required with brush replacement. Therefore, the life of the semi-molded contact plates frequently exceeds the life of the associated equipment itself.

Perhaps the most significant advance in technology has come from the perfection of these constant force wipers. Previous wiper designs utilized a form of cantilever spring arm with hand filled brushes producing a rapid, continuous decrease in brush force and unpredictable brush wear.

The new wipers are precision machined to shape, and use close tolerances to hold the change in brush force within 5% or 10% from start to finish. Such close tolerances provide improved duty cycle and phasing accuracies and greater reliability.

The diagram illustrates the more common wiring methods used and the resulting types of operation provided. The wiring method chosen determines whether a make-before-break (Shorting) or a break-before-make (Non-Shorting) operation will be provided. As can be seen, the shorting operation is to be preferred whenever the circuit allows, as it provides twice as many channels for a given switch design as the non-shorting operation. Note that in the non-shorting operation it is necessary to provide one unused contact between each active channel to prevent the wiper brush from touching two adjacent channels simultaneously. Occasionally contacts are tied together in groups to provide longer or shorter ON times for special requirements. Duty cycle accuracies of ±3% or better are now available for critical applications. The gating operation shown is a popular variation of interest, frequently used to provide a short duration pulse for timing synchronization. Note that no collector ring and only one brush is required.

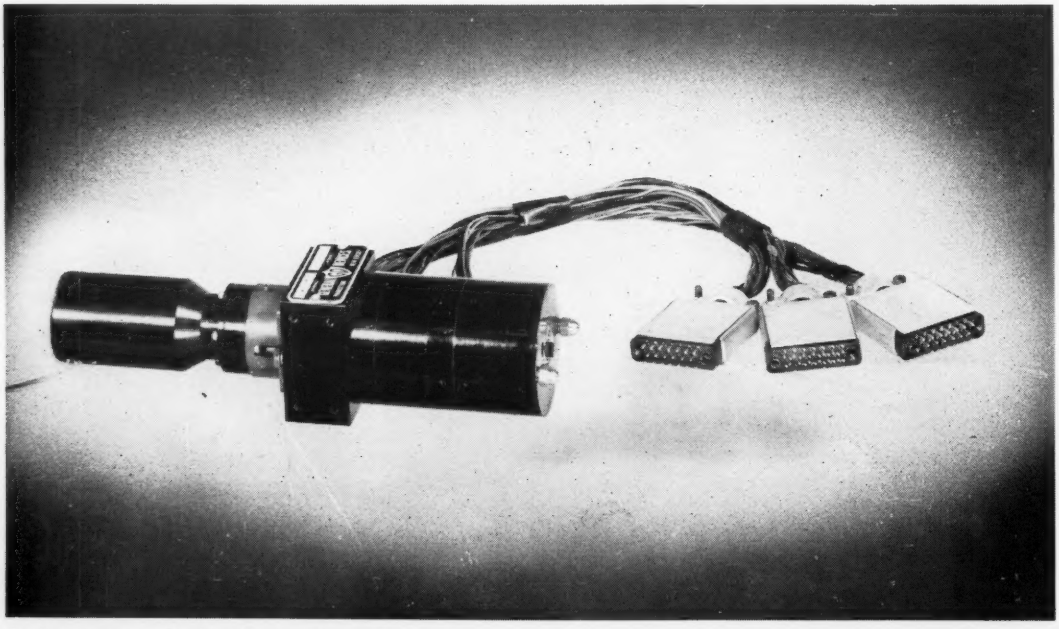
Optimum values by test

The shorting and non-shorting cycles are the preferred, optimum values determined by extensive testing for maximum reliability, accuracy and low level performance. When necessary, however, these values can be modified by varying the brush lengths, the contact diameter or the air gap.

In multiple pole designs, the phase (or timing) relationship between corresponding channels of each pole becomes very important.

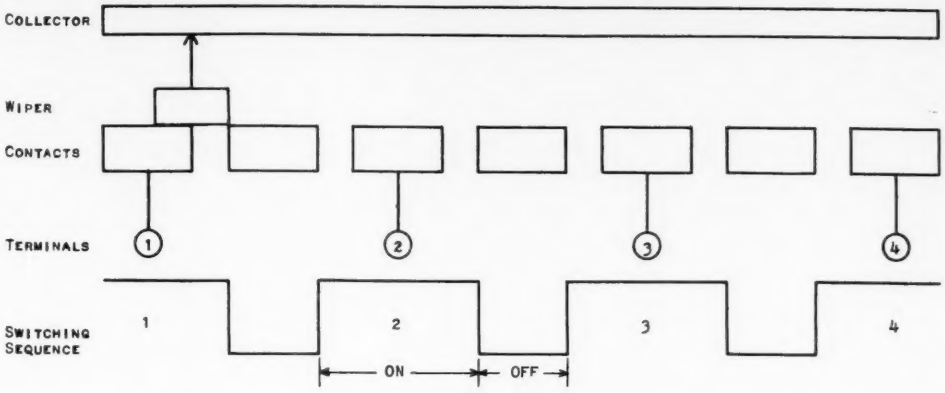
Advanced design multiple units now provide fixed phasing where up to 8 or more poles are permanently locked within close phasing tolerances by means of precision jigs. This alleviates an expensive and time-consuming customer phase adjustment. This is made possible by the new, precision machined constant force wipers which offer the distinct advantage of maintaining their duty cycle and phase tolerances throughout the complete working life of the switch.

The improvements are many but space, weight and cost are the greatest



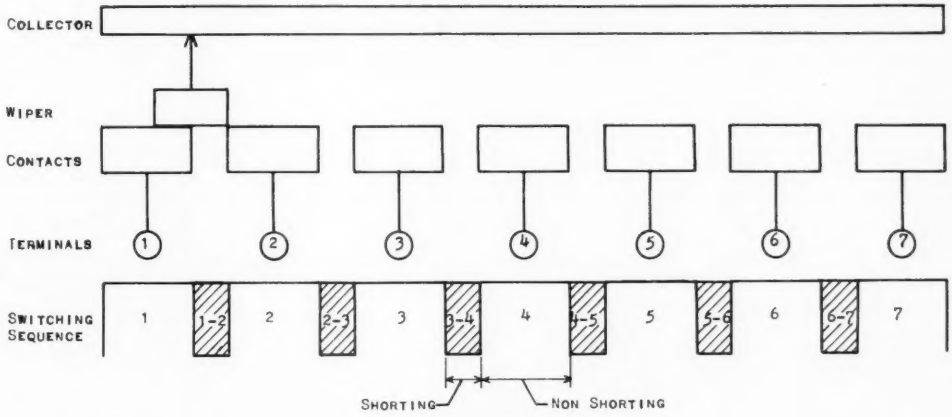
Design target of this three-pole stacked type switch is a long service-free life with ease of adjustment.

Some of the more common wiring methods used



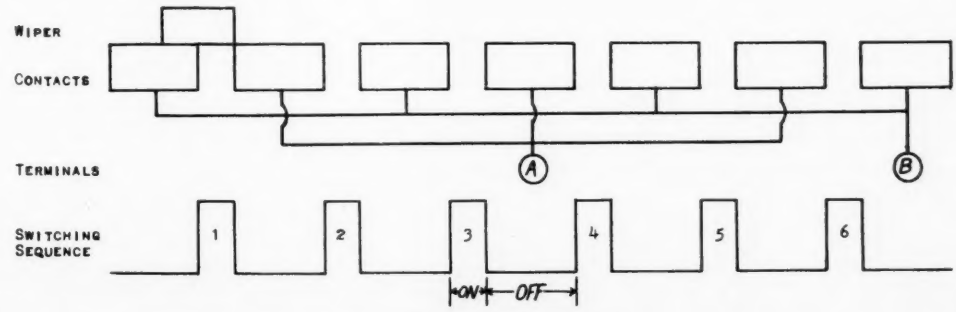
The break-before-make operation.

In the non-shorting operation it is necessary to provide one unused contact between each active channel to prevent the wiper brush from touching the two adjacent channels simultaneously.



The make-before-break operation.

The shorting operation is preferable whenever the circuit allows as it provides twice as many channels per given switch design as the non-shorting operation shown in the first illustration.



A popular variation of interest.

This layout is frequently used to provide a short duration pulse for timing synchronization or gating purposes. Note that no collector ring and only one brush is required in this circuit.

Sampling switches continued

Results of many tests indicate that the major factors of concern for successful sampling are:

(1) **Dynamic Contact Resistance Variation.** The variation of the dynamic contact resistance of the switch during the centre portion of each channel ON time is normally of little concern unless the load impedance is quite low (1,000 ohms or less). The tolerable resistance variation can be conveniently expressed by the simple formula: Maximum allowable contact resistance variation equals (Sum of source and load impedance) times (target system component accuracy desired) times (0.01).

(2) **Pick Up Potential:** Pick up can produce signals in the low millivolt region when relatively high impedances are required along with strong field intensities. However, the judicial choice of location of parts and proper shielding, filtering and placement of connections can usually reduce pickup to allowable values.

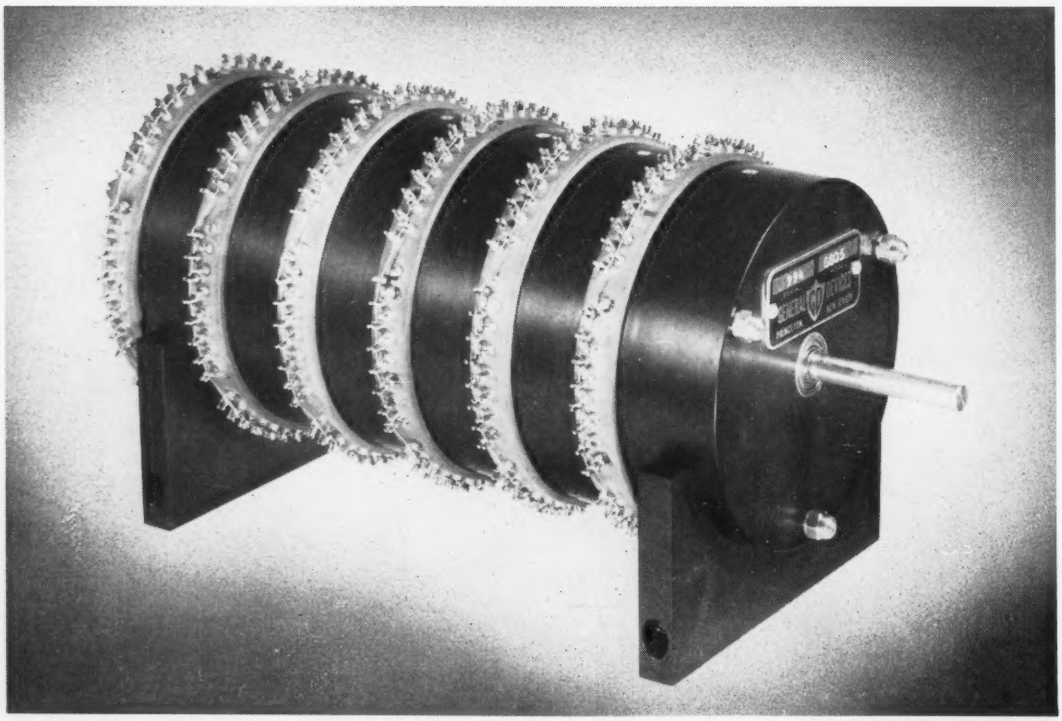
(3 **Edge Noise:** This refers to the trailing and leading edges of each ON time or pulse where any inconsistency in making or breaking can result in considerable contact resistance variation. This is usually more difficult to measure accurately than Item 1 above, but the same general formula holds true. Certain applications utilize gating circuits which select the centre portion of each channel ON time to assure freedom from edge noise. Careful investigation and experience in the choice of brush and wiper design, their physical sizes and materials and so on has been successful in limiting edge variations to normally inconsequential values.

(4) **Generated Noise:** Tests to date indicate that generated noise is normally in the sufficiently low microvolt region as to be of little relative concern. This is of course dependent on the frequency response and impedances involved. Thermo-electric, electrostatic and thermal noise sources fall into this category.

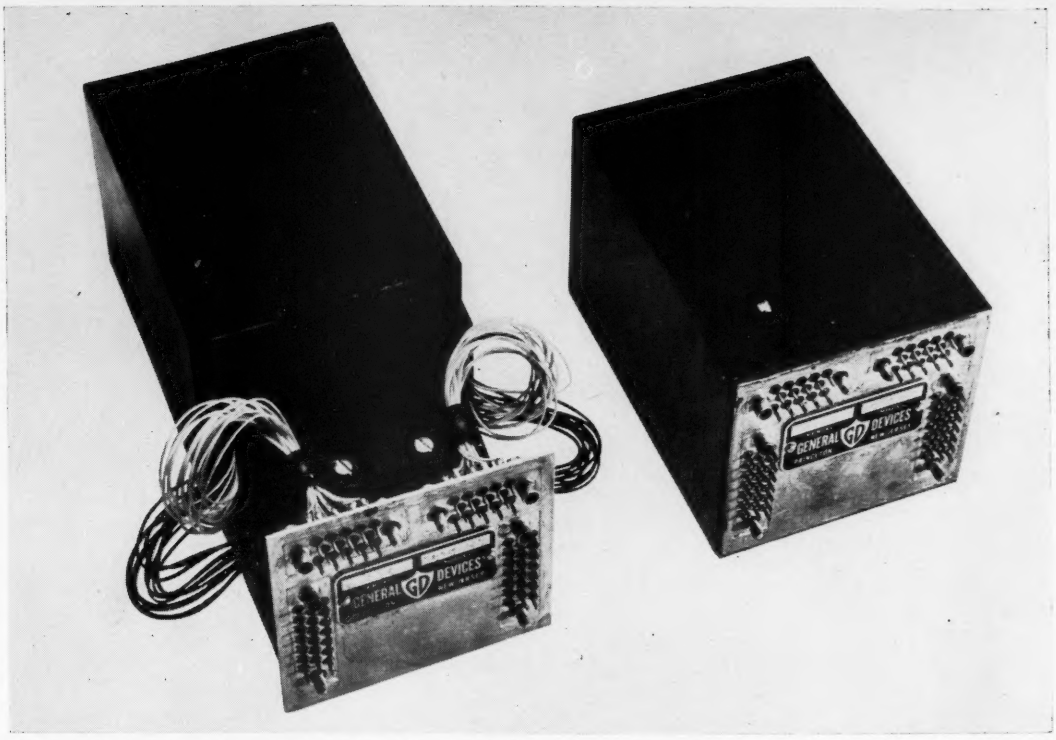
(5) **Bounce or Breaks:** This can be a severe cause of error and is due to the wiper temporarily lifting from the contact surface due to vibration and/or mechanical resonances. Careful mechanical design has effectively eliminated this problem, even under relatively severe environmental conditions.

When high system accuracies and high impedances are specified (100K to 1 megohm), the maintenance of a high insulation resistance between adjacent channels can be of interest. In practice, the initial insulation resistance between adjacent channels is many thousands of megohms. This condition normally remains until the wiper wear material collects sufficiently between contact pins so as slowly to reduce this value. Since this brush wear material can be designed to be non-adherent, the switch insulation resistance can therefore be returned to its initial high value by means of a simple cleaning at the end of each period of service free life. In critical applications of this type, a value of 100 megohms is frequently used as a criterion for the end of useful service-free life. Hence, this figure is used in all life figures mentioned in this article. For maximum service-free life, it is usually wise to limit the load impedance to about 1 megohm or less, so as to minimize possible insulation resistance problems.

Continued technical advances in high-speed rotary switch design provide



Used in the early stages of system development this six-pole switch allows rewiring without disassembly.



A five-pole hermetically sealed switch doing a job in airborne installations. It has a 400-cycle ac motor.

high performance components to tax the ingenuity of the design engineer

High speed switches are provided with integral or attached, 400 cycle ac, 60 cycle ac, 6 to 115 volt dc motors, dynamotors or suitable drive shaft extensions for external drive. The proper choice of drive source for each application is very important. Care is required to ensure sufficient starting and running torque at the temperature extremes, proper shielding and/or filtering for low level applications, and last but not least, sufficient life for the intended application. (Miniaturized motors can often have a shorter life expectancy than the switch itself). Accuracy of the sampling rate is of constant interest, usually requiring the use of synchronous ac motors or governed dc motors.

In several cases, it has been necessary to design and manufacture special motors as an integral part of the switch, where readily available types would not satisfy all conditions.

Current sampling rates range from below 1 rpm to 100 rps. However, the majority of requirements are below 30 rps, as brush wear is proportional to the switch shaft speed. The sampling rate is determined by the needs of the system. For example, in sampling potentials whose amplitudes vary, sampling principles state that in order to reproduce the original information accurately and completely from amplitude samples, the rate of sampling must be greater than twice the highest frequency component of the signal to be sampled.

This principle applies to systems in which the samples are eventually integrated to produce the original signal. Because practical components must be used in this process, the actual rate of sampling must be two or three times that mentioned above. This is usually due to the limitations in cut off and phase characteristics of practical filter networks.

For display or recording of unintegrated samples, the rate of sampling to achieve reproductions of reasonable accuracy is higher. For example, if there is a recording of the instantaneous samples representing a sampled signal whose amplitude is varying, a technique is applied known as optical integration, which involves drawing the best curve of reproduction.

The following portion of this article will describe high speed applications. These time-sharing applications fall into the following natural categories:

Telemetering

As might be expected, telemetering remains the leading source of time-sharing applications.

The term telemetering covers applications in almost every field imaginable. The largest percentage of switch applications, however, occur in airborne, plane and missile evaluation.

In frequency division systems, a typical application would be for the switch to subdivide one or more of the available FM-FM subcarrier telemetering channels into 30 to 90 (or more) low frequency subchannels. The sampling switch is used as the primary time sharing or multiplexing device in time division systems such as Pulse Duration Modulation (PDM-FM), Pulse Amplitude Modulation (PAM-FM), Pulse Position Modulation (PPM-AM) and Pulse Code Modulation (PCM-AM). In some cases, an additional switch is used in the same system for subcommutation. The

(Continued on page 76)

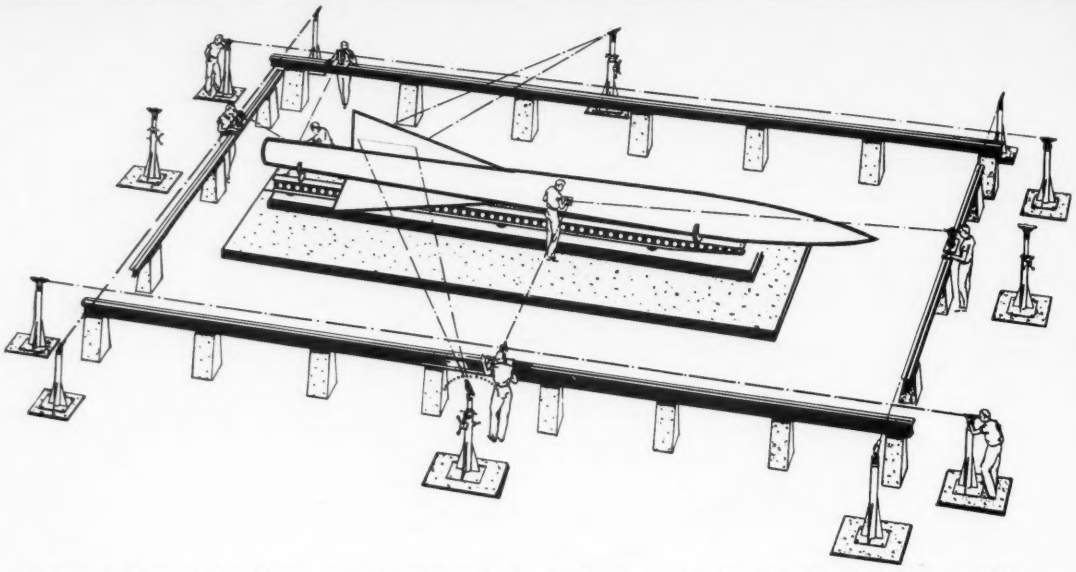


Figure 1. One of the biggest users of the optical method of tooling is the aircraft industry. This completely square set-up can also physically check the completed objects for accurate measurement.

Workshop practice

Take the headaches out of measuring

The errors inherent in conventional methods of measurement often make them unsatisfactory. Optical tooling can solve most of these problems

By W. L. Egy BRUNSON INSTRUMENT CO.

The principle used for general co-ordinate measurement is to set up a grid (or box) system of lines through space, from which measurements can be made. These lines are established and maintained by telescopes sighting into each other, into mirrors and upon fixed targets (Fig. 1). Planes at right angles to one of the established lines passing through given points furnish the means of measurement between those points.

Inasmuch as the lines of sight furnish the control, the means of support for the instruments is not critical.

The basic instrument in optical tooling is the optical transit square. This instrument will perform all the functions of optical tooling except linear measurement. It resembles the surveyor's transit, but is much more precise in every way. The line of sight is straight at all distances from 18 in. to infinity and passes exactly through the centre of the instrument. A large hole through the horizontal axis carries a semi-transparent mirror which can be observed from either end of the axis. This feature makes the optical transit square self-checking, right on the job. The plane of the mirror is at exactly 90 deg to the axis, and parallel therefore to the line of sight. Sights by other scopes can also be made through the axis.

To establish a plane at right angles to a reference line, the optical square is placed so that the axis mirror intercepts the reference line. The square is then leveled and rotated until the axis mirror is at exactly 90 deg to the reference line, as for auto-reflection or auto-collimation.

For auto-reflection, a target is centred in the front end of the line telescope and illuminated from the inside of the telescope. When a mirror in front of this telescope is exactly square with the line of sight, the target image (reflected from the mirror) will be superimposed upon the reticle of the Line Scope.

Auto-collimation is similar to auto-reflection except that the reticle of the Line Scope is illuminated and the image of this reticle reflected back onto itself. Auto-collimation can be used at very short distances and with accuracy. Auto-reflection can be used farther and also offers a pattern that always permits accurate register.

What is optical tooling?

Optical tooling has been a "must" in the aircraft industry for many years. Today many other industries find that the convenience, speed and accuracy of optical instruments will pay dividends in many cases.

Conventional methods of measurement, using a surface plate, angle blocks, micrometers, height gauges and so forth, require time and patience, even on simple work. Where structures are complicated, extreme accuracy is impossible. These limitations are due to errors in squares, the sag of long scales or bars, distortion due to unequal temperature, as well as the inaccessibility of points to be located. Optical tools, on the other hand, furnish right angles accurate to 0.003 in. in 100 ft lines of any length which do not sag; readings on any visible point; and scales always at the most convenient location. Installations need not be complicated and are quite easily operated by shop men.

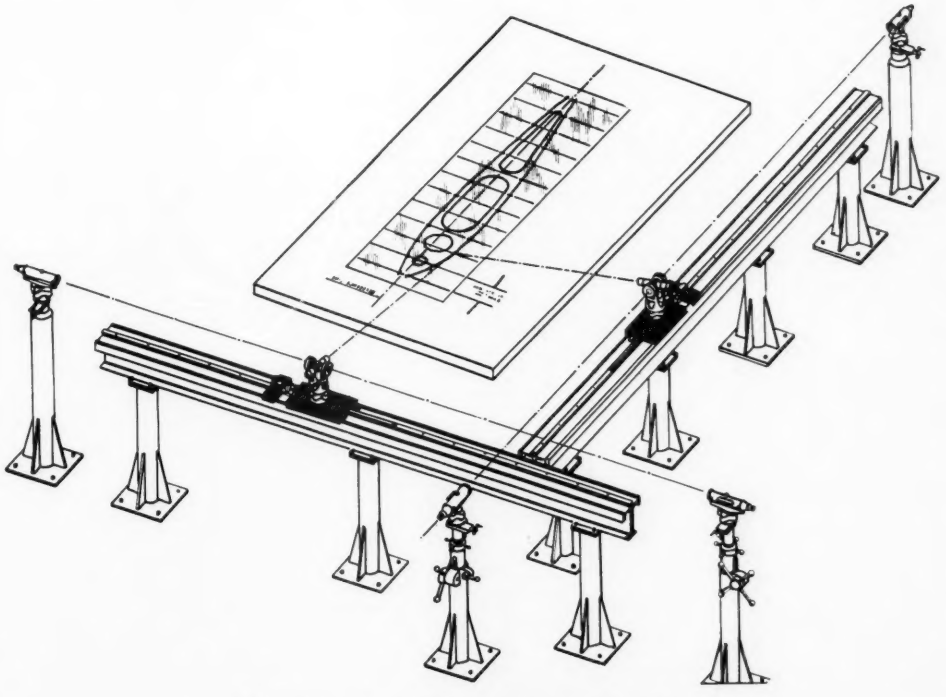
When properly located by either of these methods the telescope of the optical transit square will sweep through a plane at exactly 90 deg to the reference line. Two planes, so located, will be parallel and therefore the same distance apart at any point. If two such planes pass through two selected points, the distance between the planes (measured at any convenient location) will be the distance between the two selected points, in a direction parallel to the reference line.

The same method is used to locate a second reference line at 90 deg to the first one. The telescope of the square is used to sight-in the second line which, in turn, is permanently established by means of another line scope, optical square, or a target (Fig. 2).

Second direction measurements

An optical transit square moved from point to point along this 90 deg reference line is used to set up planes at right angles to those planes mentioned above, and is thus used for measurements in this second direction. In this way, measurements (Fig. 2) can be made between any two points that can be seen through the telescopes, even though objects may lie between these points.

The most convenient way to make linear measurements is to mount the optical transit square on tooling bars, as shown in Figs. 1 and 2. The position of the



Establishing the second line with another line scope

Figure 2. With the instruments rigged as shown here, measurements can be made between any two points visible through the telescopes even though objects may lie between these points.

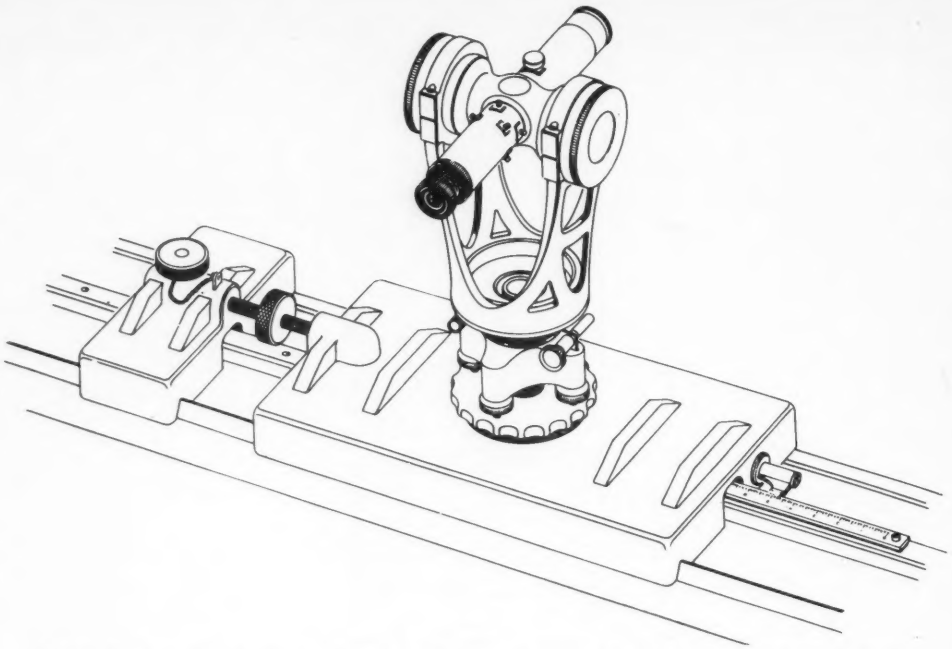
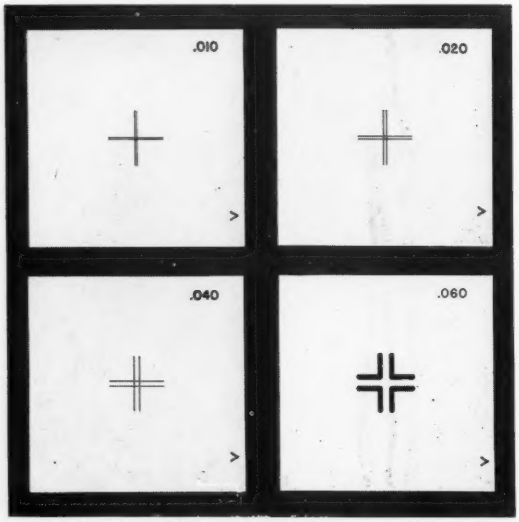


Figure 3. The instrument resembles the familiar surveyor's transit, but is much more precise. The line of sight cuts the instrument's exact centre and is straight from 18 in. to infinity.

Optical tooling

continued



Four of the targets

Figure 4. White space between the lines varies according to sight length. Centre is 1 in. from V edge.

square on the tooling bar is measured by a vernier and scale, plugged into a jig bored master index bar (Fig 3). The tooling bars need not be exactly straight, since the reference line of sight, together with the axis mirrors of the squares, furnishes the control for the system. The line scopes that hold the reference lines are mounted on independent stands beyond the ends of the tooling bars.

Target type is important

The type of target used for sighting is a very important factor when precision measurements are being made. A single line on the telescope reticle cannot be accurately pointed at a single line on the target. Precise pointings will be made consistently if the target carries a double line, with enough space between the lines to show white on both sides of the cross hair (Fig. 4). These targets are commonly 2 in. square, with the width of white space between lines 0.005 in. for short shots of 5 to 10 ft and wider for longer sights. The space is not critical, since the centre will be accurately located. The centre of the white space is exactly 1 in. from the edge marked with the V. For regular sights, repeated often, the white space selected should include the **tolerance** allowed—then **any** sight between the lines will be within tolerance, even though not in the centre.

So far, a few general principles used in optical tooling have been explained and illustrated. The manufacturer should be consulted when selecting equipment

for any specific problem and instruments purchased to give results needed. More instruments and attachments can be added as needed.

The optical transit square can be obtained with a plain telescope and an ordinary level dial. The following attachments can be added in the field as needed:

(1) Co-incidence level, either plain or reversible. This level is read from the eye-end of the telescope. The prisms show both ends of the bubble brought together, but moving in opposite directions. It is several times more accurate than the older type of open bubble.

(2) Optical micrometer for objective end of telescope. This will shift the line of sight 0.100 in. each way (shift measured to 0.1001 in.).

(3) Elbow eyepiece, swivel, for taking high angle shots.

(4) Auto-reflection target, for use with external lighting.

(5) Auto-reflection target, with internal lighting.

(6) Auto-collimation lighting attachment to illuminate reticle.

(7) Projection of reticle image onto the object or target. This requires a special reticle that should be factory installed (Fig. 5).

(8) Combinations of the above items.

The principles described above will be illustrated by an imaginary problem of the simplest type—that of aligning several rollers (or other members) parallel to one another. Imagine a lengthy machine with cross rollers which must be accurately parallel, though the distance apart is not critical. A reference line can be established along one side, parallel to the centre line of the structure, as described above. A line scope on an adjustable stand will serve to maintain the reference line.

An optical square, mounted on a second stand, can be set on the reference line, opposite one of the rollers. It is then squared by auto-reflection, using the line scope for control. The telescope of the square provides accurate alignment of the roller. The square can be moved to each of the rollers in turn and the operation repeated.

If it is necessary to level the rollers, a prismatic reading level can be attached to the optical square telescope. By using a double line target (Fig. 4) attached to the slider of the height gauge, readings can be taken to 0.001 in.

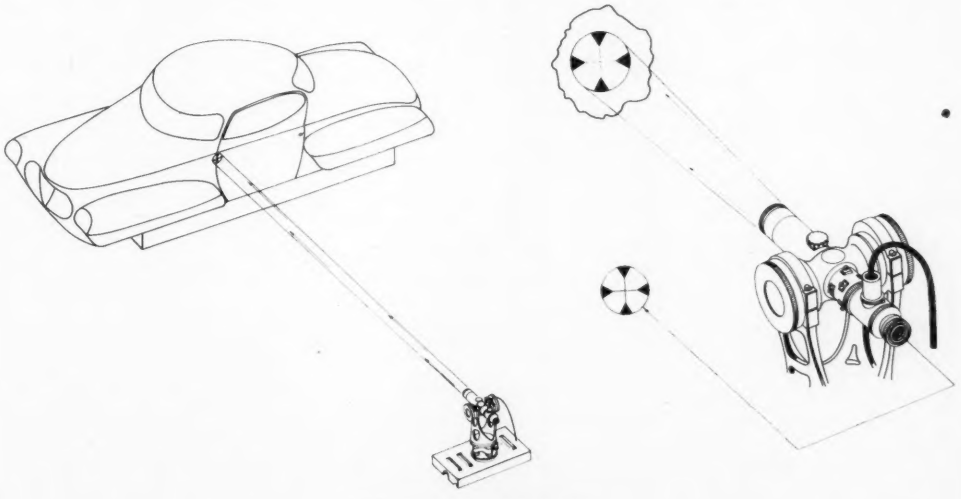
Spacing the rollers

Should it be necessary to space the rollers accurately, a tooling bar beneath the reference line can be used to support the optical square. The location of the rollers can then be easily measured by the master index bar, scale and vernier on the tooling bar.

From this simple problem let the imagination travel to some large complicated structure, surrounded by a double-deck system of tooling bars, one set above, the other below, carrying a dozen or more instruments that are being operated simultaneously.

Wherever measurement becomes a problem, whether simple or complicated, it is likely that optical tooling, carefully selected and conscientiously used, will save money, time and some unnecessary headaches. ★

Optical tooling gives high returns in convenience, speed and accuracy



The projection attachment

Figure 5. It is sometimes easier to project an image of the cross-wires instead of looking through the telescope. A turn of a knob disconnects the projection feature for normal use.

Design trend

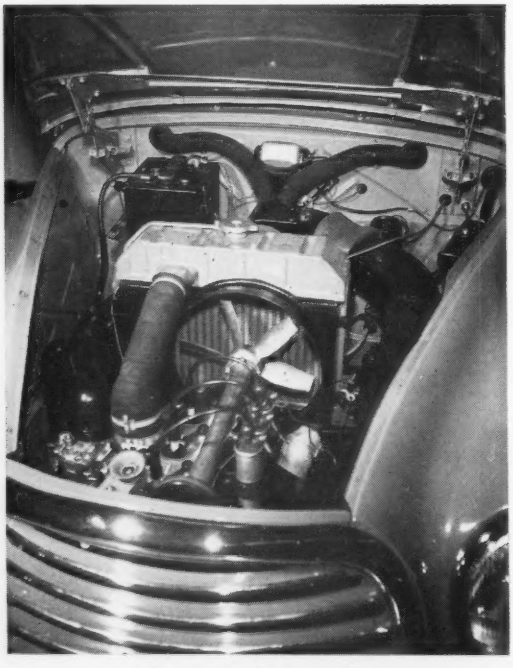
Auto design sheds its strait-jacket

A common sight in Germany, the DKW car is new in Canada. Two-stroke engine and front-wheel drive are two of its original design features

Have you sometimes wondered if Detroit has not got itself into a sort of strait-jacket in car design? Of course, the American car buyer seems to prefer evolution by easy stages, as witness his cool reception to the Stout "Scarab" and the Chrysler "Airflow," while the high cost of tooling a new model (about $200 million) puts a severe penalty on mistakes. But surely there must be other ways of putting two seats on a wheeled platform and propelling them over the countryside.

So the innovations presented by a newcomer from Germany, the DKW car, are welcome. It has two special features, each of which makes it unique over here. Though it has been manufactured in Germany for the past 28 years, it is the only car, on the Canadian market, with a two-stroke engine and the only one with a front-wheel drive.

Originally, DKW stood for "Dampf-Kraft-Wagen," a steam-powered car built in Germany 40 years ago. Later on, the factory turned to the manufacture of a two-stroke motorcycle, Das Kleine Wunder (The Little Marvel) and later still, to the manufacture of a car fitted with this same type of engine. The DKW company then became part of the Auto Union, a group famous for its successful racing cars. After the second war, the factory was completely rebuilt at Dusseldorf.



The two-stroke powerplant

Doubly strange appearance of the three-cylinder unit results from mounting the radiator behind the engine.

The advantages of the two-stroke gasoline engine, as every outboard marine engine user knows, are its light weight and compactness for a given power output. In the DKW, this compactness is a great advantage, since, in a front-wheel-drive car, the engine must be placed ahead of the front axle. The engine is water-cooled and again for compactness and weight distribution, the radiator is placed behind the engine. Thus the whole installation is most accessible and any part of the engine may be reached from the front of the car.

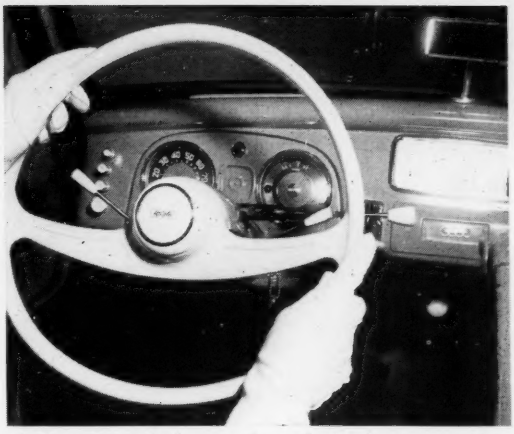
The engine has 3 cylinders and thus has a smoothness of torque equal to that of a conventional 6-cylinder, 4-stroke engine. The mixture is drawn from a Solex downdraft carburetor and is pumped into the cylinders by the changing displacement in each of three separated crankcases, just as in a marine outboard engine. In fact, the DKW engine can best be considered as a large outboard engine (in the 25 to 30 hp class) to which one more cylinder has been added. Its bore and stroke, 2.8 x 3 in., and its maximum power output of 14 hp per cylinder (42 hp in all) at 4,200 rpm happen to be almost exactly equal to the average figures for the six largest American outboard engines.

Gasoline-oil mixture

Since it is not practicable to have oil flying about in the crankcase of a crankcase-pumping two-stroke engine, lubrication is not under pressure and the oil is mixed with gasoline in the fuel tank. Without pressure lubrication, plain bearings are not too reliable under heavy loading, so the main bearings are three roller and one ball bearing and the connecting-rod big-ends are fitted with needle bearings. This means that the crankshaft must be built up by pressing the crankpins and main journals into the crank throws. Accordingly it can only be serviced as an assembly, complete with bearings and connecting-rods.

The engine has no camshaft and, in fact, no auxiliary shafts of any sort. There is no oil pump and the gasoline pump is driven by the changing pressure in No. 1 crankcase. The distributor, which runs at engine speed, is driven from an extension of the crankshaft; it distributes low-tension current to three separate ignition coils. There is no water pump and the two outside

The DKW has a large rear window. It is now easier for the back seat driver to say who the driver just missed.



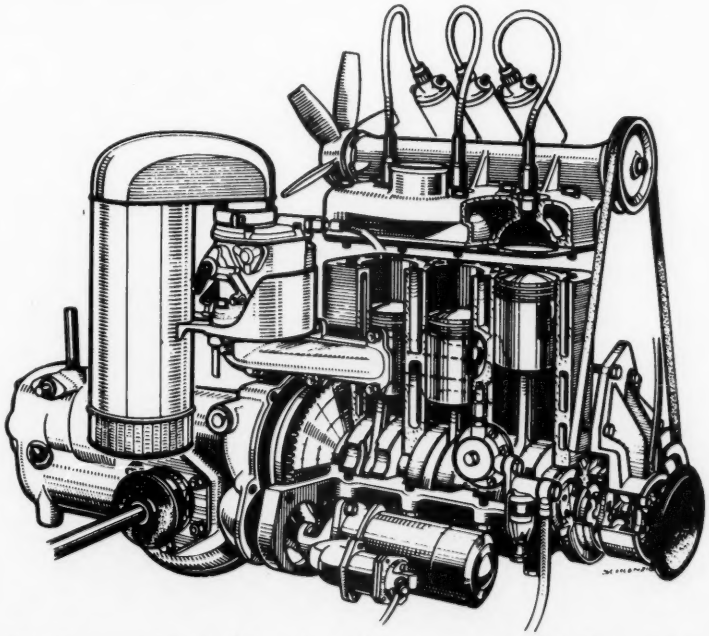
A flattening of the steering wheel's lower arc gives the driver's legs clearance between seat and wheel.

accessories, the generator and the fan, are belt-driven.

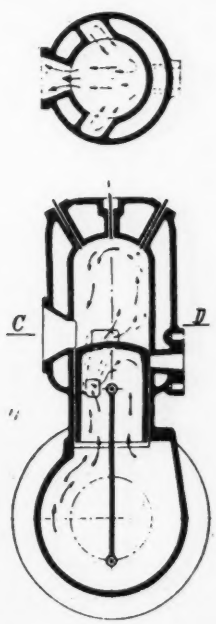
A three-cylinder, in-line engine has an unbalanced primary couple and secondary couple. The engine is mounted on large rubber pads, but is rather rough when idling, possibly because the mounting pads are too low down. It is remarkably smooth when pulling, however, and the acceleration is very good. The top speed is said to be 78 mph and the fuel consumption 32 mpg.

The layout of the front-wheel drive is conventional, with a single transverse semi-elliptic spring above and wishbone links below. The engine is in front of the axle and the transmission behind. The passenger cars have a single transverse spring at the rear, while the light trucks have torsion-bar springing at the rear, so as to leave an ideal loading platform, without any encroachment other than the small wheel boxes. ★

Only seven moving parts and roller bearings spell long engine life



Unit dispenses with camshaft, valves and tappets and has unconventional fuel pump, distributor.



Right diagram shows loop scavenged two-stroke principle. Intake port is at the gap below "D".

Canadian Institute of Radio Engineers Convention

Interest in the Canadian IRE Convention and Exposition at Exhibition Park, Toronto, on October 1, 2 and 3 runs high. Here are the exhibitors at time of going to press.

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ELECTRONICS & COMMUNICATIONS MAGAZINE. 336.
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MYCALEX CORP. OF AMERICA. 132.

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Technical Programme

The wide range of subjects covered by some 125 papers so far accepted promises a busy time for technically minded visitors determined to attend all those in their special fields. The papers are divided into groups under: semi-conductors, nucleonics, electronic tubes, etc. No attempt has been made to give a complete list—just a representative selection.

The Control of Guided Missiles, A. Ratz, Canadian Westinghouse Co. Ltd., Hamilton.

Problems in Radiation Instruments for Defence, A. Hendrikson, D.R.-T.E. Defence Research Board, Ottawa.

Use of Transistors in Nucleonics, F. S. Goulding, A.E.C.L., Chalk River.

Testing Facilities for Colour Television Receivers, R. Anthes, Canadian Westinghouse Co. Ltd., Brantford, Ontario.

Design Considerations for Colour Television I.F. Amplifiers, K. R. Van der Keyl, Canadian Radio Mfg. Corp. Ltd., Toronto.

Wide Band Power Amplifiers, P. Gomard, T. S. Farley Limited, Hamilton.

A New Approach to Variable Frequency Oscillator Design, F. A. Bailey, Canadian Marconi Co., Montreal.

Electronic Instrumentation for the Location and Assaying of Radio Active Ores, G. G. Eicholz, Dept. of Mines & Technical Surveys, Ottawa.

Magnetic Amplifier Servo Control for NRU, N. F. Wood, Ferranti Electric Ltd., Toronto.

A Tuning Indicator for Television Receivers, W. E. Liddell, Canadian Radio Mfg. Corp., Toronto.

Closed Circuit Television, W. M. Booth, Rogers Majestic Electronics Ltd., Leaside.

Microphonic Testing of Tubes, S. Love, Radio Valve Co. of Canada Ltd., Toronto.

Cold Cathode Tubes, A. K. Knowles, Rogers Majestic Electronics Ltd., Leaside.

Some Applications of Electronic Data Processing Systems in the Air Transport Industry, L. E. Richardson, Trans-Canada Air Lines, Montreal.

Applications of Symbolic Logic to Electronic Engineering, G. B. Thompson, Northern Electric Co. Ltd., Belleville.

The Canadian Post Office Electronic Mail Sorter, Mr. W. J. Turnbull, Deputy Postmaster General.

Fundamental Principles of the Canadian System, Dr. M. Levy, Post Office Dept., Ottawa.

A Reflection Theory for Beyond the Horizon Propagation, H. T. Friis, A. B. Crawford and D. C. Hogg, Bell Telephone Laboratories, Holmdel, N.J.

Scatter Propagation, P. L. Rice, C.R.P.L. Bureau of Standards, Boulder, Colo.

High Frequency Transistor Amplifier Design, G. T. Lake, D.R.T.E. Defence Research Board, Ottawa.

Logical Use of Transistors in Communications Applications, S. Kagan, Crosley Defence and Electronics Div., Moffats Ltd.

Analysis of Heart Murmurs by Electronics, R. S. Richards, National Research Council, Ottawa.

Electronics in Medicine, W. E. Hodges, Consultant, Toronto.

Mechanized Processes for Design and Manufacture of Printed Wiring Units for Data Processing Systems, D. E. Nuttall, Ferranti Electric Ltd., Toronto.

Discussion of Methods of Producing Prototype Printed Circuit Boards, I. Meitlis, Canadian General Electric Co. Ltd., Toronto.

Magnetic Recording Tape, L. F. Bennett, CAMSA, Ottawa.

Ferrites in Microwave Work, D. J. Whale, Canadian Westinghouse Co. Ltd., Hamilton.

The Cost of Decibels, Frederick Gall, Canadian Marconi Co., Montreal.

Electronics in Meteorology, W. R. Smith, Department of Transport, Ottawa.

Computer Circuits Using the P-N-P-N Transistor Element, C. D. Florida, DRTE, Defense Research Board, Ottawa.

Transistorized Logical Building Blocks, D. C. Redpath, Crosley.

A Canadian Designed 150 mc Vehicular Communication Equipment, G. M. Koch and W. Ornstein, Canadian Marconi Company, Montreal.

An Experimental Radio Teleprinter Broadcast Service for North-Atlantic Air Routes, B. G. Doutre, Trans-Canada Air Lines, Montreal.

Magnetoresistive Amplifiers, A. Aharoni and E. H. Frei, Weizmann Institute of Science, Rchovoth, Israel.

Electronic Power Supplies, T. C. Gams, NJE Corp., Kenilworth, N.J.

Common Errors in Measurement and Design, W. C. Benger, Northern Electric Co. Ltd., Belleville.

Cascade Co-operative Education, Richard Scott, Canadian Aviation Electronics Ltd., Montreal.

A Graphic Volume Unit Recorder, D. H. McRae, Canadian Broadcasting Corp., Montreal.

The London-Windsor Microwave System, R. D. Pynn, Canadian General Electric Co. Ltd., Toronto.

Thermal and Field Effects in Point Contact Diodes, R. E. Burgess, University of British Columbia, Vancouver.

Recent Developments in the Diffusion Technique Used to Produce Semi-Conductor Devices, J. Y. Perron, Northern Electric Co. Ltd., Montreal.

Automation in the Laboratory — Description of a Strain Recording and Plotting System, G. F. Kelk, G. F. Kelk and Co., Toronto.

Video Transmission Requirements and Testing Techniques, A. Ste. Marie, Canadian Broadcasting Corp., Montreal.

Electronics for Defence, M. L. Card, Dept. of National Defence, Ottawa.

Packaging Guided Missile Electronics, J. W. Keenan, Canadian Westinghouse Co. Ltd., Hamilton.

Automatic Range Radar for the F-86 Aircraft, E. Herbert, Canadian General Electric Co. Ltd.

Pattern Range for HF Shipborne Antennas, J. Y. Wong and J. C. Barnes, National Research Council, Ottawa.

Some Conductivity Characteristics of Canadian Terrain at Medium Radio Frequencies, P. A. Field, DRTE, Defence Research Board, Ottawa.

New Scaling Techniques, W. D. Howell, AECL, Chalk River.

Sub-carrier Matrixing in Color Television, A. E. Kimmel, Canadian Radio Mfg. Corp. Ltd., Toronto.

The Application of Phase Locked Frequency Control Systems, E. H. Hugenholtz, Rogers Majestic Electronics Ltd., Leaside.

Design Considerations for Reliability, A. S. Best, Canadian General Electric Co. Ltd., Toronto.

Applications of Statistical Quality Control, J. J. Fitzsimmons, Canadian Marconi Co., Montreal.

Two-Dimensional Slotted Arrays, G. C. McCormick, National Research Council, Ottawa.

System Reliability in Reactor Control, E. E. Siddal, AECL, Chalk River.

Development of Cross-Polarized Antennas, R. Meier, RCA Victor Co. Ltd., Montreal.

Interference Immunity of TV Receivers, E. Luedicke, RCA Victor Co. Ltd., Renfrew.

Design and Performance of a 2KW CW Klystron Amplifier for C-Band, E. A. Conquest, Varian Associates of Canada Ltd., Georgetown.

An Investigation Into Simple Methods of Forecasting the Life of Electron Tubes with Indirectly Heated Cathodes, R. H. Taplin, Canadian Marconi Co., Montreal.

Automatic Recording and Processing of Operating Data at Hydro's Niagara River Plants, J. R. Leslie, HEPC, Toronto.

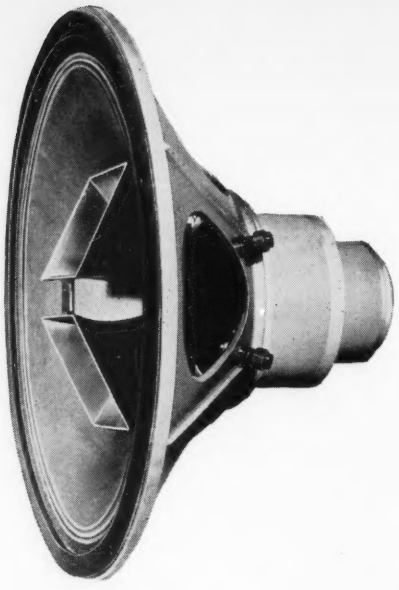
Magnetostriction Delay Lines, J. V. Scott, Ferranti Electric Ltd., Mount Dennis, Toronto.

The "Scad"—A Servo Calibrating Auto Densitometer, P. D. P. Smith, Electrodesign, Montreal.

Electrical component

Speaking voice of a movie big noise

European ears first heard the Cinemascope soundtrack over this new design 'speaker



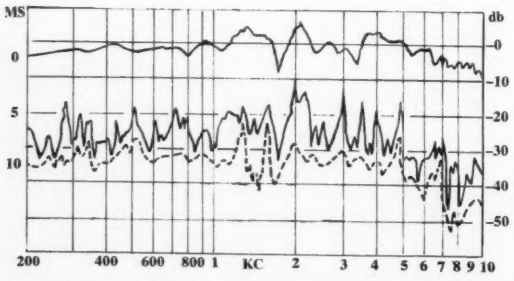
Side view of BTH loudspeaker at right shows twin flare HF horn.

When it had its first showing in Europe, the Cinemascope sound-track reached the audience over a loudspeaker of completely new design. This speaker is a product of the British Thomson-Houston Company and they supplied the entire projection and sound equipment.

The unit, type K10A, is a co-axial dual-channel speaker with an 18 in. diameter LF cone assembly having a twin-mouthed HF horn mounted in the centre pole. This is coupled by a special form of phase-equalizer to an anodized aluminum alloy diaphragm. To divide the high and low audio-frequency energy from the amplifier, an external filter unit with a cross-over frequency of approximately 1700 cycles per second is used.

The speaker was originally designed, and has been used with considerable success, for the auditorium sound channel of large Cinemascope installations throughout Great Britain, where the wide frequency range and low level of distortion, coupled with the high power handling capacity of approximately 20 watts audio, have proved extremely effective. The speaker is now being offered to the general public and should prove of special interest to the enthusiast.

The HF metal-diaphragm electro-dynamic unit has high stability, good power-handling capacity and low-level distortion. During development, various alternatives, such as electro-static, ionic and ribbon reproducers, were tried for the HF duty, but none of these was found as satisfactory as the final design.



A method of delayed resonance response measurement determined the frequency characteristic of speaker.

By extending the HF horn in front of the centre LF diaphragm, distortion due to intermodulation has been kept to a relatively low level, while still maintaining the good "presence" for which coaxial sound sources are noted, even close to.

The twin flare of the HF horn has a wider polar characteristic in the plane through the line joining the mouth centres than in the plane at right angles to this and so uses the high-frequency sound energy to the best advantage.

The "pepper pot" construction at the end of the centre pole provides a mechanically stable and acoustically effective phase equalizer. This minimizes turbulence and interference of the phase of the sound pressure at the higher audio frequencies, which frequently occur due to variation of path lengths from parts of the diaphragm to the throat of the horn. The horn flaring nearly conforms to the standard expression:

$$A = A_o\, e^{mx}$$

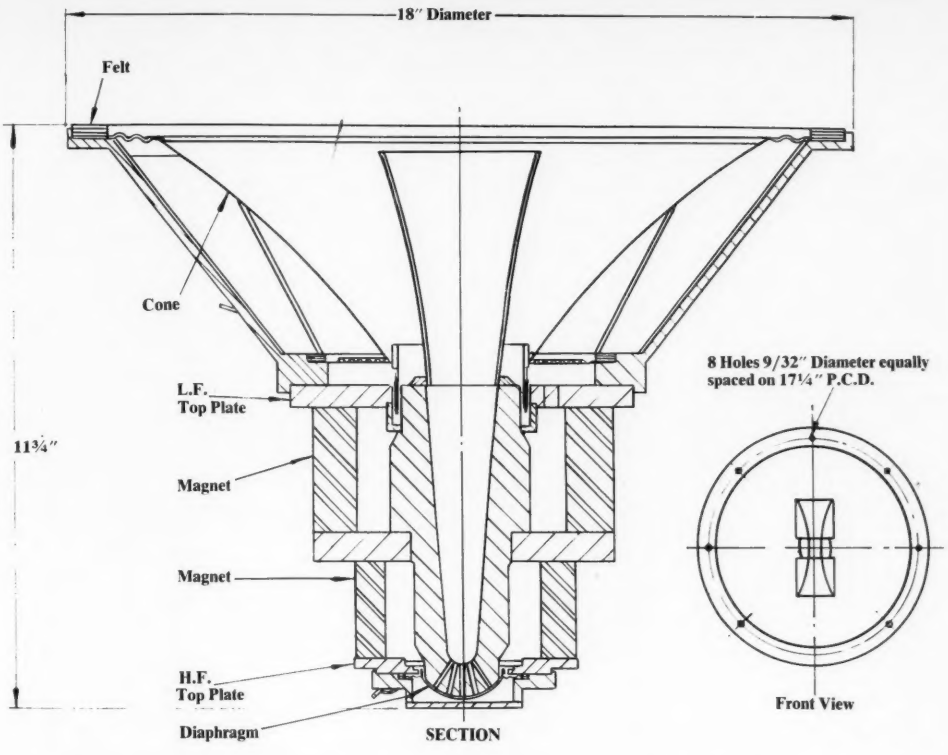
Here, A = area at mouth, A_o = area at throat, e = 2.7183, m = flaring constant and x = distance from throat to mouth.

This gives a flaring constant which allows for effective coupling of the diaphragm to the air down to a frequency of approximately 1200 cycles per second. With a 3x3 in. dimension for each mouth of the twin horn, the low frequency cut-off due to the mouth dimensions is also in the same region.

The above factors determine the cross-over frequency of approximately 1700 cycles per second, together with the narrowing polar diagram for an 18 in. cone assembly above this frequency. The frequency chosen allows relatively small components, particularly the air-cored chokes, to be used in the filter circuit.

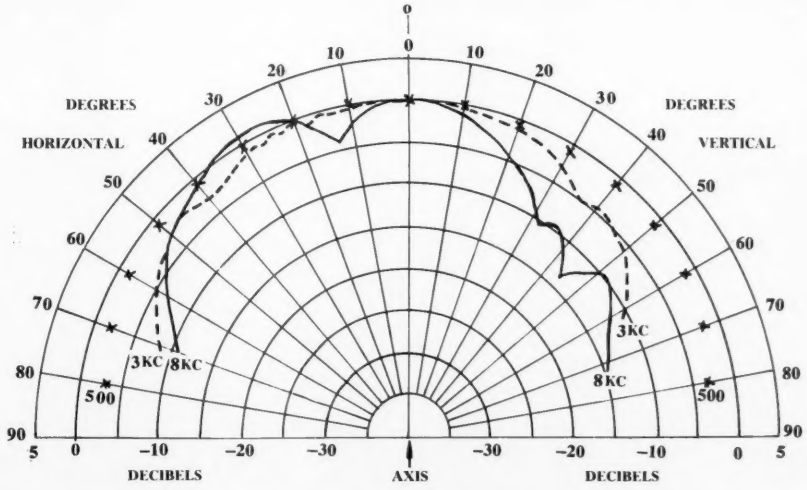
The company's filter unit, type G2A, is a two-section inductive/capacity type with an attenuation of 12 db per octave at cross-over.

(Continued on page 79)

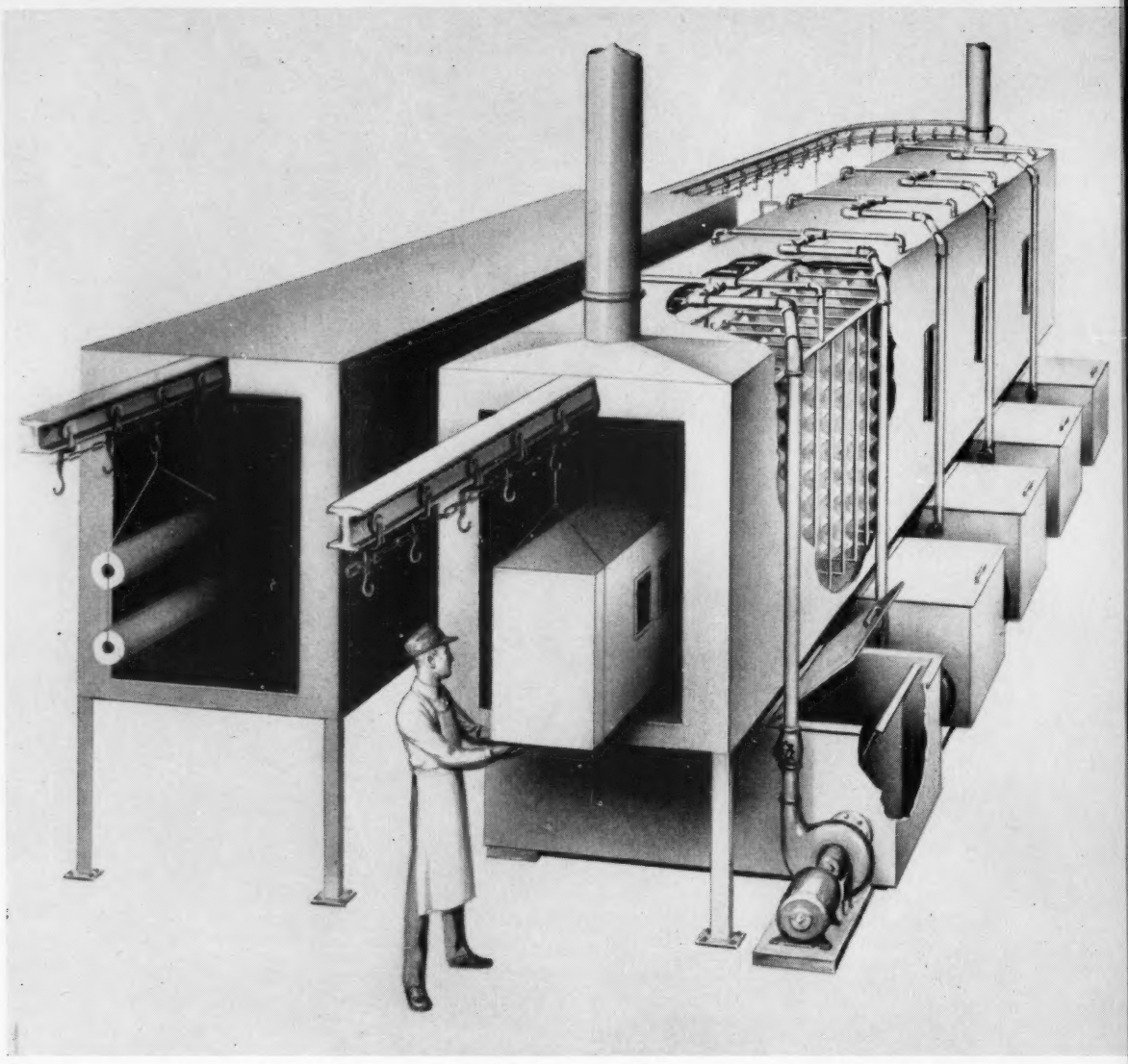


A sectional view of the BTH loudspeaker showing the arrangement of the HF horn and diaphragm.

Wide frequency range is coupled with a very low level of distortion



The BTH loudspeaker's excellent characteristics can be quickly seen from this polar diagram.



The box is entering the first of five spray phosphating stages. Pipes at left are emerging from the drying oven.

Phosphating can make a finish stick

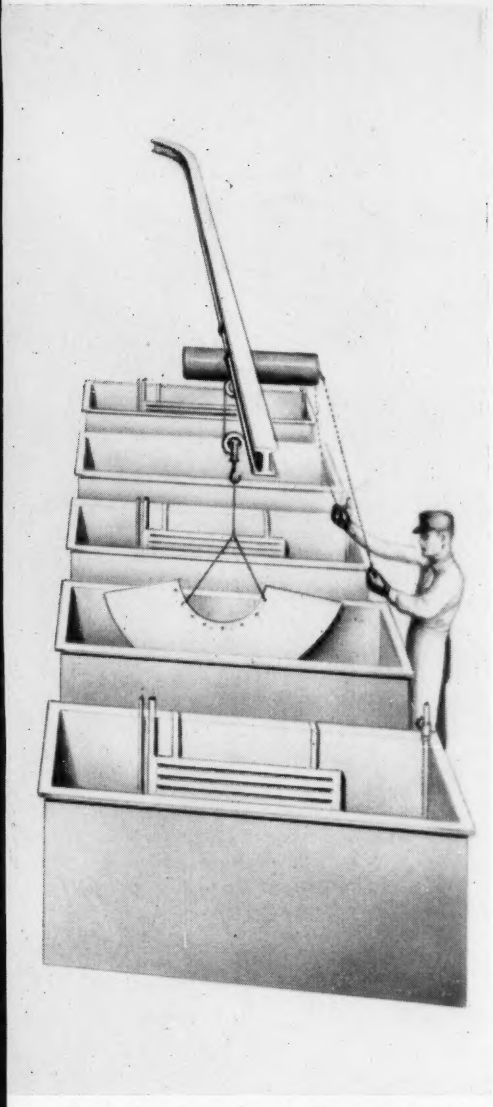
Treatment improves paint-holding and gives resistance to salt spray

By Jack H. Goodyear J. W. REX CO.

Design engineers should always remember that phosphate coatings, by themselves, do not drastically increase the corrosion-resistance of steel, but act as an intermediate agent to hold supplementary coatings. The illustration shows how effective is treatment with phosphate solution in holding paint and giving superior resistance to salt spray.

Basically, four types of phosphate coating are used on steel. Each has certain physical characteristics and applications which must be weighed against cost to assure selection of the proper coating.

The first is the so-called **amorphous type of iron phosphate.** Chief advantages of this type of coating are its paint-holding characteristics and low cost. In general, it is the cheapest type of phosphate coating to apply. Weight of the coating is usually around 20 to 60 milligrams (mg) per sq ft. While the corrosion resistance of this coating is not comparable to the other types of phosphate coating, it is superior to that of



Same five stages by the dip coating process.

The drawing of wire is made easier by zinc-iron phosphating first.

steel which has received no surface treatment at all.

Amorphous iron phosphate coatings are usually applied to certain types of consumer goods where the paint system has to be as cheap as possible and where the painted product will not be exposed to the elements.

The second type to be considered is the **zinc phosphate** coating, crystalline in nature, with a coating weight of 100 to 600 mg per sq ft. This coating is used more extensively than any other type. It has excellent paint-retention properties and prevents blistering and undercutting of the paint by corrosion, should the paint coating become scratched or damaged in some manner.

Zinc phosphate coatings are used for both commercial and government work. Consumer products, such as automobiles, refrigerators, cooking ranges and the like, generally use a zinc phosphate coating as a pretreatment to paint.

The third type of coating is also a **crystalline zinc phosphate,** differing from the above type in the thickness of coating applied to the metal surface. This coating generally weighs 1,000 to 4,000 mg per sq ft and possesses a larger crystal structure than the previous type.

Basically, this larger crystal, zinc phosphate coating is used as a corrosion-resistant base, usually being supplemented by the addition of oils, waxes and similar additives. Occasionally, however, this type of coating is used without the addition of these supplementary treatments. This, the writer feels, is a mistake, because the addition to it of even very small amounts of oil will keep the manufacturer out of trouble under normal atmospheric conditions.

The large crystal zinc phosphate coating is not recommended as a paint base. In order to obtain the required thickness of phosphate coating, the crystalline structure becomes too large and too absorptive for paint. Paint applied on top of this coating will not give the expected "mileage." In addition, the paint will lose

its lustre due to the surface condition.

The chief use of this particular phosphate coating is for hardware, nuts and bolts, ordnance parts and items in which appearance is not too important but corrosion resistance is.

The fourth type of coating is also a thick (1,000 to 4,000 mg per sq ft) crystal-type coating, consisting basically of a **manganese phosphate structure.** This type of phosphate coating has not the same uses as those previously described.

The main advantage of a manganese phosphate coating is its anti-friction qualities. This imparts good wear-resistance to bearing surfaces.

Similarity to ice on water

In using this coating, however, always bear in mind that it is similar to ice on water: any gouging or digging will break through the coating. Yet for sliding wear it has excellent characteristics, especially when some type of oil or wax lubricant is used as a supplementary treatment.

This supplementary treatment is often used on cylinder walls, piston rings, gears, cams and other sliding surfaces. Another interesting use for this material is on steel which is to be pressed, drawn or reshaped in some way. By using a manganese phosphate coating, the metal can be made more workable and tool life prolonged.

For a better understanding of phosphate coatings and their properties, it is necessary to know the basic steps necessary in applying them. These are:

(a) **Cleaning.** Basically, the procedure begins with a cleaning operation. As with any chemical process—whether it be a conversion coating, electrochemical coating or plating—proper cleaning is a "must," in order to obtain satisfactory coatings. Not only must the surface be free from oil, grease and other physical dirt; it must be chemically clean as well—free from oxides and other products of corrosion.

This operation may call for several stages in the phosphate treatment. The initial step is to remove the physical dirt by alkaline cleaners, emulsion cleaners, solvents or vapors. Next comes chemical cleaning by means of a pickling operation. In many instances, this step can be eliminated, provided the surface is free from rust and other corrosion products. In some instances it may be more economical to remove heavy rust and scale (due to forging, heat-treating or welding) by mechanical means such as wire brush, sand-blasting, grinding and so on.

(b) **Phosphating.** After proper cleaning, the material is subjected to the phosphate bath, where the reaction between the chemicals and the metal surface takes place.

(c) **Rinsing.** After initial rinsing, the coating which has formed is rinsed a second time with an acidulated rinse. Generally, these steps are performed in one of two ways: dipping or spraying, the method finally chosen usually being determined by production requirements and the size or shape of the articles.

In dipping, the parts are handled in baskets, barrels or on racks, a method which does not, however, lend itself to high production.

In the spraying operation, the parts are generally hung from an overhead conveyor or laid on a moving belt. The speed of the operation is determined by the speed of the belt and the size of the spraying chambers. There is a more rapid formation of the coating in the spraying operation, due to the impingement of the solution on the surface.

The cost of spraying can be reduced to three stages. This is accomplished by cleaning and phosphating (amorphous iron-phosphate) in the same bath, and then following with the rinse and acidulated rinse. As mentioned previously, however, this is a coating primarily designed for a paint base.

Defects of the process

There are certain difficulties and defects to watch out for:

A powdery and nonadherent coating can cause considerable grief when followed by paint. The result is usually poor paint-adhesion and a rough finish.

A nonuniform coating is usually caused by improper cleaning or by poor chemical balance in the phosphate bath. Again, poor paint adhesion results.

The size of the crystalline phosphate is very important. On those surfaces which are prepared as a paint base, a coarse crystalline structure will cause roughening of the painted surface. The result is poor paint "mileage" due to high paint absorption.

On surfaces which are being prepared for anti-friction service, and so receive supplementary treatment with oils, waxes and similar lubricants, the coarse crystalline structure is, of course, quite helpful.

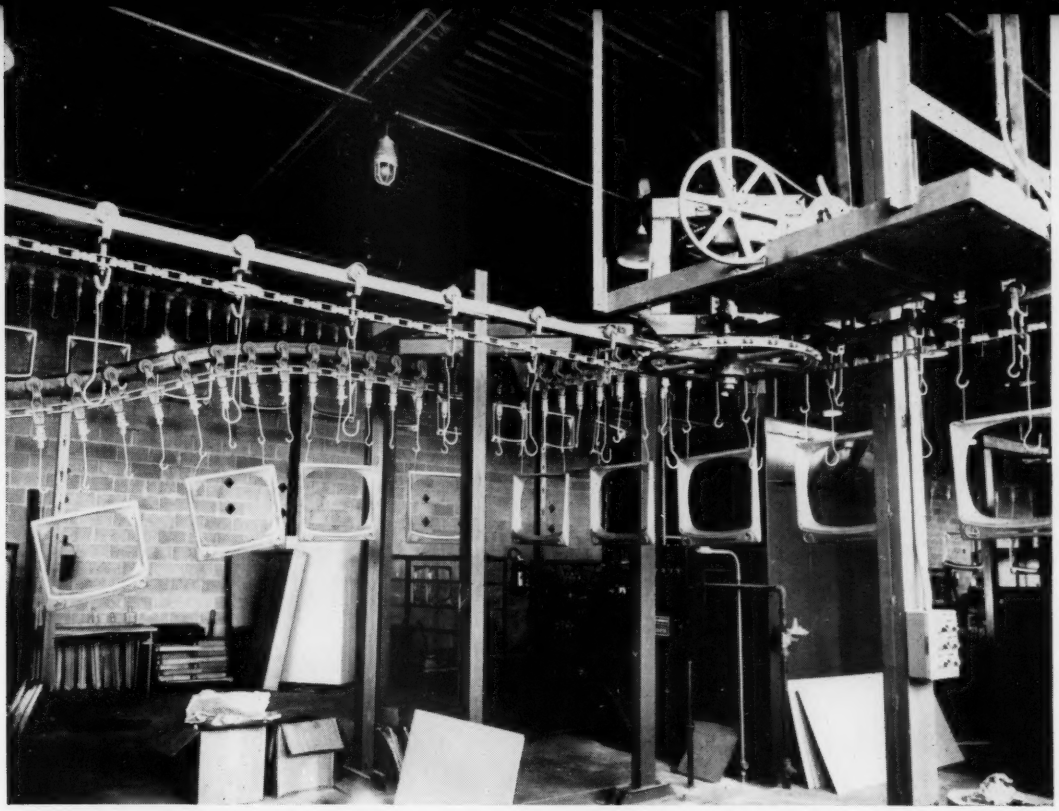
The formation of a rust flush during the processing operation is one of the most prevalent difficulties encountered. There are several reasons why this rust flush forms: Improper chemical balance of the phosphate solution, improper cleaning, improper rinsing—any of these will cause difficulties. Even though it is light, rust can cause trouble when it comes to paint adhesion. ★

Points you must consider

Phosphate coatings have a variety of uses. They offer a flexible, versatile tool for use by the design engineer. They represent a good, economical, easy-to-apply coating—if the phosphate is chosen correctly.

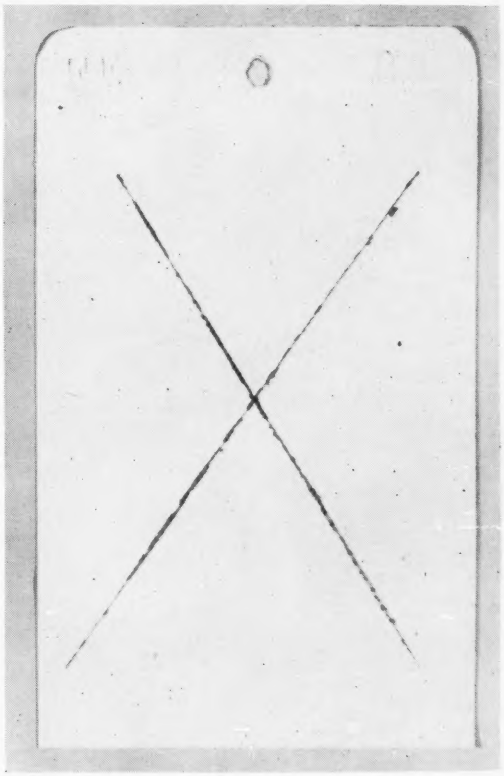
Next time, before you are tempted to dismiss the job summarily with "phosphating," think of the:-

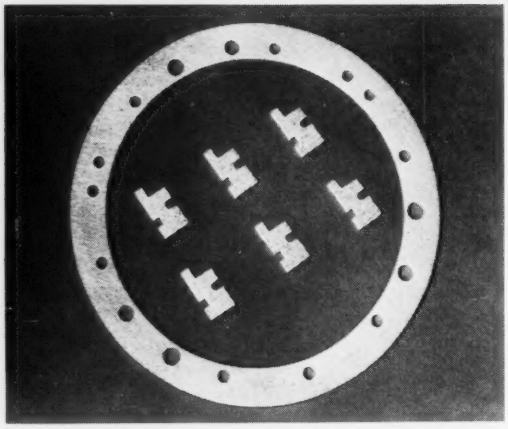
- **Requirements of the job**
- **Cost**
- **Thickness required**
- **Type of protection needed**
- **Types of coating available for use**
- **Methods of application**
- **Possible difficulties that might be encountered should processing methods prove faulty. Then you will be ready to specify phosphate coating to fit your job.**



Die cast zinc parts for a new television set, just phosphated, move from the drying oven to priming stage.

Improved paint adhesion after phosphating is clearly shown here. This steel panel received only chemical cleaning whereas this one was cleaned and then phosphate coated before the painted finish was applied.





Abstract pattern of parts made from polyester resin.

These glass laminates are new

Resistance to most acids is good

A line of polyester resin glass mat laminates, having properties similar to the reinforced plastics used in sport car bodies, is available from National Vulcanized Fibre Co. The advantages of the sheet laminates are: dimensional stability and exceptionally high impact strength with more than average arc resistance.

The properties of dimensional stability and impact strength suggest important mechanical applications, such as fabricated containers, cams and so on. The new materials can also be used for armature slot wedges, spacers, switchboard panels, arc chutes and the like. Their chemical resistance makes them useful materials in areas of high humidity or acid fumes.

There are three standard grades of these laminates, obtained by impregnating glass fibre mats with a liquid polyester resin containing inorganic fillers and a catalyst. The treated mats are heat cured under low pressure to produce a hard laminate. General properties of the three grades and their identity are (see Table) as follows:—

GP-9100 A general-purpose, medium-cost sheet with good electrical and mechanical properties.

GP-9104 Low-cost grade with lower mechanical properties than GP-9100 and fair electrical properties.

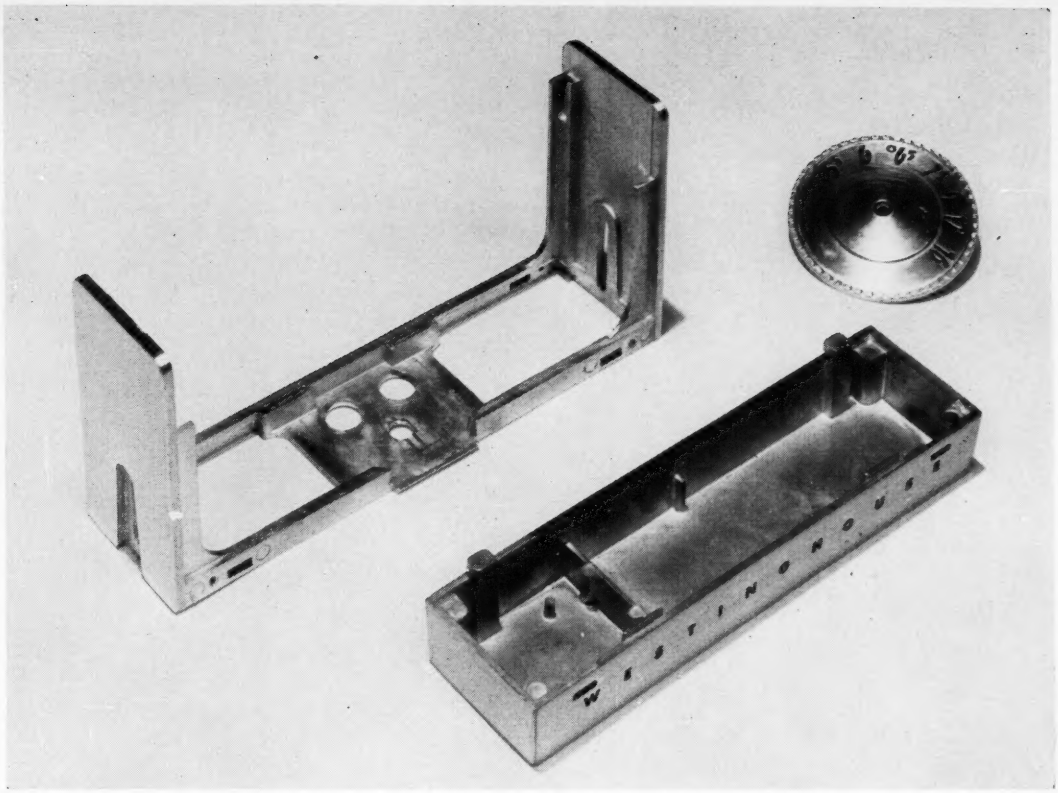
GP-9202 Flame resistant grade. Also the best electrical grade, except for arc resistance.

The Table summarizes the physical and electrical properties of the three grades. Standard sheet sizes are: 32 x 36 in., 32 x 48 in. and 32 x 74 in.

The polyester resins generally have good chemical resistance to most acids and most solvents, such as carbon tetrachloride, toluene, gasoline and ethyl alcohol.★

Typical properties of glass mat laminate ⅛ in. thick.

Grade	GP-9100	GP-9104	GP-9202
Color (natural)	Tan	Light Cream	Dark Cream
Flexural Strength (psi)			
Lengthwise	26,000	20,800	29,800
Crosswise	22,800	20,200	22,000
Impact Strength (ft lb/in)			
Lengthwise	11.0	9.0	10.0
Crosswise	10.0	8.0	9.0
Bond Strength (lb)	1000	1200	1200
Rockwell "m," 23C	98	98	108
Dissipation Factor, 1 megacycle, Condition A	0.0130	0.012	0.011
Dielectric Constant, 1 megacycle, Condition A	4.40	4.78	3.97
Dielectric Strength			
Parallel to laminations (kv) Cond. A	52.0	57.5	51.0
Perpendicular to lam. (volts, mil) Cond. A	400	475	500
Insulation Resistance (megohms) Condition A	1×10^6	1×10^6	1×10^6
Arc Resistance	88	96	3
Water Absorption (% gain) Cond. D-24/23	0.21	0.31	0.14
Density	1.75	1.82	1.79



Three thin-walled lightweight zinc die castings form the frame, base and dial for a new portable radio.

Die casting has most of the answers

What are the advantages of the die casting method? Speed and economy often happily married to little necessity for machining top the list

Die casting is like this.

Die casting has been aptly termed the shortest distance between raw material and finished part. Into one end of a die casting machine goes molten alloy—out of the other comes a stream of identical metal parts. Many such die castings are ready for use "as is." When machining and finishing are required, these operations can be performed efficiently and economically.

As in most other fields of endeavor, however. die casting is not as easy as it appears. A great deal of "know-how" must be applied before die castings can spew from a machine at maximum speed and with the utmost in physical and mechanical properties. Prospective users of die castings should take their problems to the job shop die caster at an early stage in the design.

One of the greatest advantages of die casting is that most dimensions can be held within limits so close that little or no machining is required. Most holes can be cored, sometimes as small as 3/32 in. diameter. Coring is usually done to tap drill size. A die can produce many thousands of castings without removal and usually without significant change in the dimensions of the die casting. The minimum size produced is smaller than for other methods of casting.

Properties of die cast parts are superior to those of corresponding parts cast by other processes. Surfaces, as die cast, are smoother than for any other form of die casting. Alloys of four different base metals afford a fairly wide choice. In general, corrosion resistance rates are good. Most alloys are readily plated and all can be otherwise finished with a minimum of surface preparation.

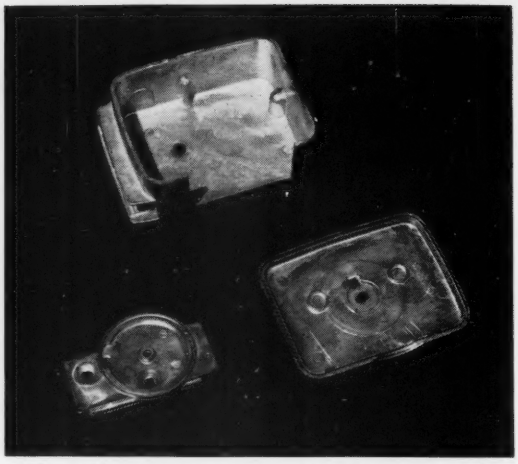
Flexibility of design means that die castings have more complex shapes than other types of casting. They can have thinner walls and integral fastening elements can be die cast in place and result in economies in assembly. External threads are readily cast whilst internal threads can be cast economically in some instances.

The economies of the die casting process can be fully realized only when the part is designed specifically for this method of manufacture. Basically it should be remembered that the ease with which a die cavity can be filled—and the die casting ejected—dictates the speed of production. It is therefore an important factor in the ultimate cost. The ideal design for a particular die casting is best determined by consultation with the job shop die caster.

The table gives data on maximum weight, minimum wall thickness and dimensional tolerances. This information if for average conditions and the approximate limits set may be varied under special conditions. When there is doubt about producing a part that does not come within the limits indicated, the advice of an experienced die caster should be sought. In fact, any new die casting design should be presented to the die caster for criticism before it is too late to make changes. His experience will often point to possible economies or an alternative construction that may decrease both die costs and die casting costs, without having any bad effect on the function or appearance of the die casting.

The dimensions and limits in the table apply to the die casting as it comes from the die and without machining, other than flash removal.

Since the castings are made in steel dies, the design must provide a definite parting line to ensure removal of the casting from the die. General data on drafts required



Die cast aluminum components for the camera at right. Shown here are two sides of the case and lens mount.

Flexibility of design means that die

is given. Cores must be capable of ready withdrawal from the die casting and must not involve undercuts, unless "loose pieces" are used.

Simple forms that are easily cut into the die blocks help to reduce costs but it is quite possible to make

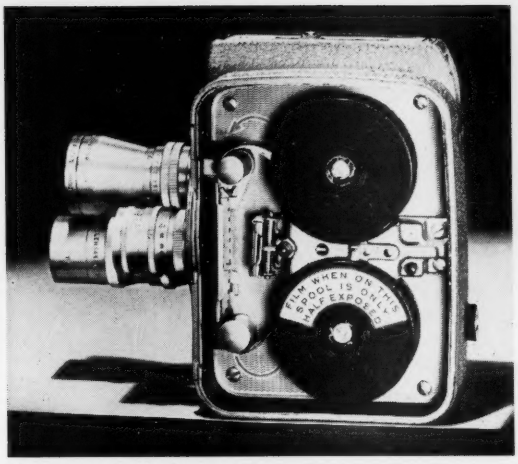
Approximate Dimensional and Weight Limits for Die Casting in Different Alloys

Data apply to average conditions. For exceptional conditions, larger castings, closer dimensional limits and thinner sections may be feasible.

Type of Alloy (base metal)	Zinc	Aluminum	Magnesium	Copper
Maximum weight of casting (lb.)	35	20	10	5
Minimum wall thickness, large castings (in.)	0.050	0.080	0.080	0.090
Minimum wall thickness, small castings (in.)	0.025	0.050	0.050	0.050
Minimum variation per inch of diameter or length from drawing dimensions over one inch†	0.0015	0.0015	0.0015	0.002
External cast threads (max. no. per in.)	24	24	16	10
Min. diameter of cored holes (in.)††	0.094	0.125	0.125	0.250
Minimum draft on cores (in. per in. of length or diameter)	0.005	0.010	0.010	0.020
Minimum draft on side walls (in. per in. of depth)	0.007	0.015	0.010	0.020

†Larger variations may be anticipated across die partings or where fits of slides or cores are involved.

††Depends to a considerable degree on length of core, although smaller cores than here indicated are seldom employed.



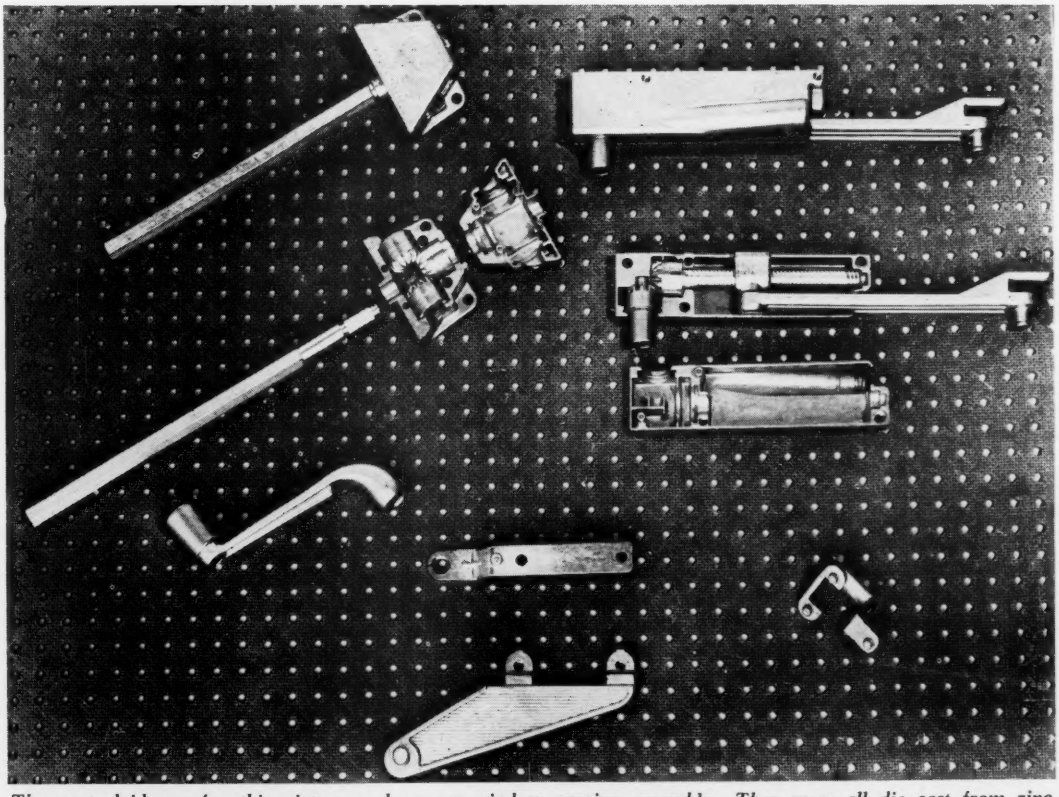
An exposed side view of the turret-type movie camera. The "works" fasten mechanically to the housing parts.

The lens mounting plate can be clearly seen here. The die cast surface proved ideal for a "wrinkle" finish.

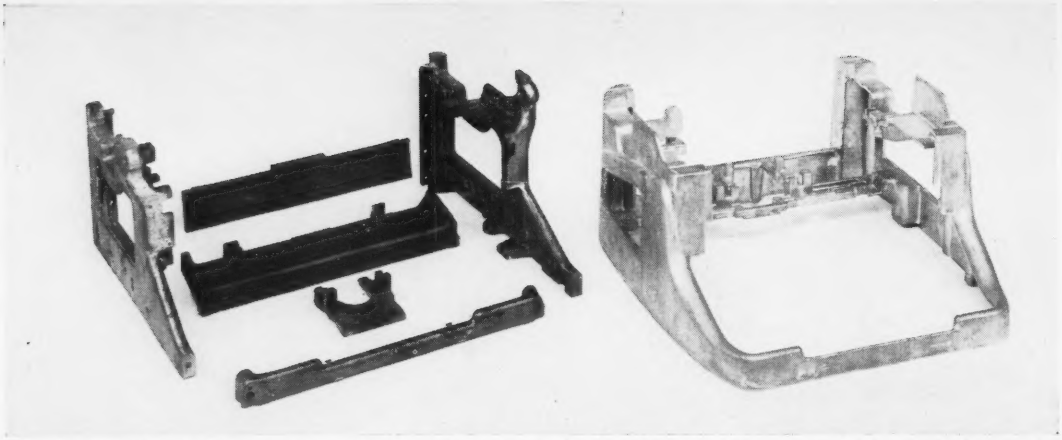
castings can have more complex shapes than any other type of casting

complex forms when necessary. Parts having external undercuts, or projections on side walls, often require slides that materially increase die costs. In many cases, however, there are resultant savings of metal in the die casting or other advantages, such as more nearly uniform wall sections, that offset the extra cost or effect a net economy in over-all cost of the part. This is especially true when large quantities are involved, as a small saving per casting may fully justify a much more expensive die.

Rules for the design of any die casting must be



The parts laid out for this picture make up a window awning assembly. They were all die cast from zinc.



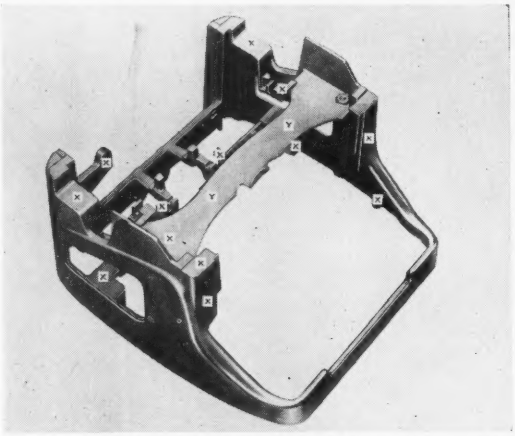
The framework of this typewriter was formerly comprised of six iron sand castings which required extensive machining, finishing and assembling. Here's a better result achieved from a one-piece aluminum die casting.

Die casting continued

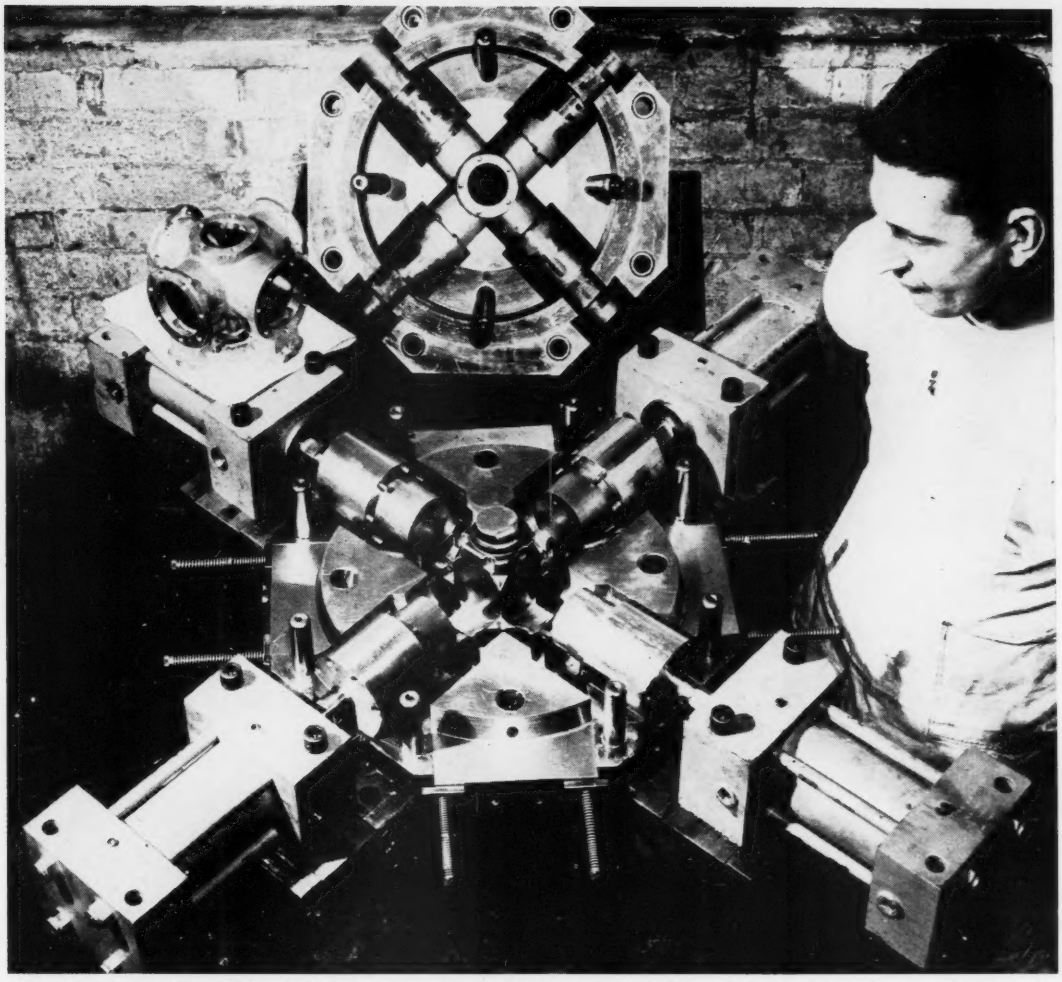
somewhat general in character and subject to many exceptions. It is possible, however, under certain conditions, to frame rules that indicate what is desirable or otherwise, especially when it is desired to produce at the minimum cost likely to yield a satisfactory product. Rules here given are intended merely as a guide to good design. Most of them have exceptions and there are numerous cases in which other considerations outweigh the advantage that may be attained by following a particular rule. Where the rules can be followed, however, costs are likely to be lower or better die castings will result, or both.

- Keep wall sections of uniform thickness for low production costs. Where variations in thickness are necessary, the transition from thin to heavy sections should be as gradual as possible, to avoid stress concentration.
- Keep over-all dimension as small and weight as low as other requirements permit.
- Specify sections as thin as can be die cast readily, if they still give adequate strength and stiffness. Ribs frequently help in giving maximum strength with minimum weight.
- Remember that plain flat areas are the most difficult to die cast. If slightly curved surfaces or decorative effects can be employed, minor surface imperfections can be avoided.
- Coarse external threads are easily die cast, particularly if located at the die parting, but internal threads are frequently obtained more economically by machining.
- Avoid nonessential projections and keep shapes as simple as other requirements permit. Any obstruction to removal of die casting from the die naturally retards the casting cycle and adds to cost. Every possibility of avoiding undercuts by slight changes in design should be fully explored.
- Coring should be specified where holes or recesses can be cored without undue die cost, and where savings in metal and over-all cost will result. Design cores so that withdrawal is facilitated to avoid complicated die construction and operation. Make cored holes and recess of such shape that core will be minimized and still satisfy other requirements. Where cores are specified, see that they are not so slender as to be easily bent or broken. Frequent replacement of cores can increase costs substantially.
- Do not specify the coring of holes in walls less than 3/16 in. thick, or of very small holes, unless assured of a net saving in cost over subsequent drilling or piercing.
- Never ask for tolerances closer than are actually needed. Unusually close cast dimensions can be achieved, when necessary, but such tolerances add considerably to casting costs and in some instances can be obtained more economically by subsequent machining.
- Provide for sufficient draft on sidewalls and cores to ensure removal of the die casting from the die without distortion.
- Provide for fillets at all inside corners and avoid sharp outside corners unless deviation from this practice is warranted by some special consideration.

As the metal cools, it tends to shrink with considerable force against parts of the die. The location and magnitude of this shrinkage stress in the die casting determines the location and size of the necessary ejector pins. The die casting design must provide for the location of



Points marked "X" eliminate machining and assembly. "Y" is the casting's gate discarded after machining.



Eight hydraulically pulled side cores were part of this intricate die for casting a new type of gas meter. Aluminum, zinc and bronze parts make the meter an outstanding example of creative design in die casting.

these pins, and the effect of the resulting ejector marks on the appearance and functioning of the die casting must be considered.

Specify integrally die cast fastening elements if they result in lower assembly and over-all costs, and specify die cast threads when a net saving over cut threads will result.

Die castings which have a significant effect upon the appearance of the finished product should be designed to have adequate eye appeal and to harmonize with mating parts. Where inserts to be die cast in place are essential, they should be so designed as to be readily inserted and firmly held in the die and proper anchorage provided to retain them in the die casting.

Design the die casting so that a minimum of machine work is required and flash removal costs minimized. Also allow sufficient metal to clean up properly where machining is specified but not so much as to require cuts of unnecessary depth. In die castings to be polished or buffed, all areas to be finished thus must be so disposed as to be brought easily into contact with the wheels or belts to be used for the purpose, avoiding sharp edges.

The following is a comparison with other methods:

Stamping: An assembly made up of die castings may result in lower die and tool costs. It frequently requires fewer parts and few assembly operations; can be held, in general, within closer dimensional limits; can have almost any desired variation in section thickness; involves less waste in scrap; and can be produced in more complex shapes than can be obtained in stamped form.

Screw Machine Products: Die castings are often produced more rapidly, involve much less waste in scrap; can be made in shapes difficult or impossible of production from bar or tubular stock, and may require fewer operations.

Sand Casting: Die casting requires much less machining; can be made with thinner walls, can have all (or nearly all) holes cored close to size; can be held within much closer dimensional limits; can be produced more rapidly in dies that make many thousands of castings without renewal; do not require new cores for each die casting; are easily provided with inserts cast in place; have smoother surfaces and involve much less labor cost.

Permanent Mold Casting: The die casting can be made to closer dimensional limits and with thinner sections;

(Continued on page 66)

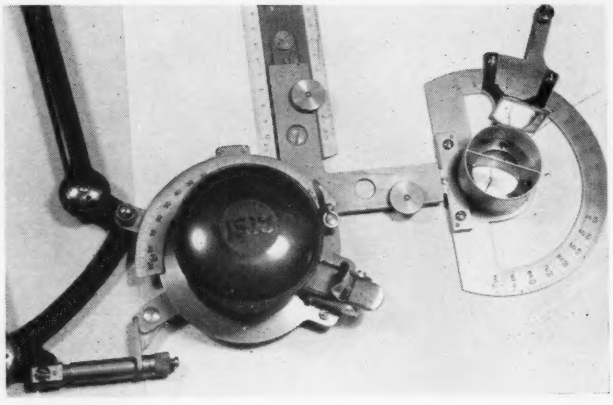
These instruments will save your time

Design engineers need mathematical instruments to do their tedious work

DERIVIMETER

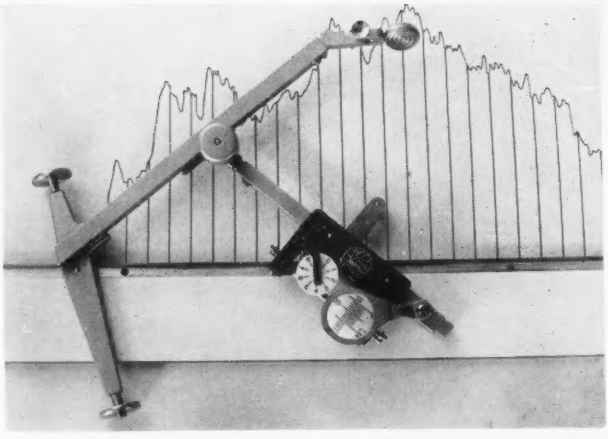
The derivimeter, made by Ott of Germany, is used for determining the direction and numerical value of the tangent at a point on a given curve. No. 332 GOJAG is for use on a tee-square only whilst No. 334 GOJOK can be used both on a tee-square and a drafting machine. The instrument is most useful, for example, in evaluating dilatometer curves from material tests. Its net weight is 2 lb, including case.

For Type 334, it is necessary to know exactly on which drafting machines the derivimeter will be used, so that the required joint parts can be supplied.



INTEGRIMETER

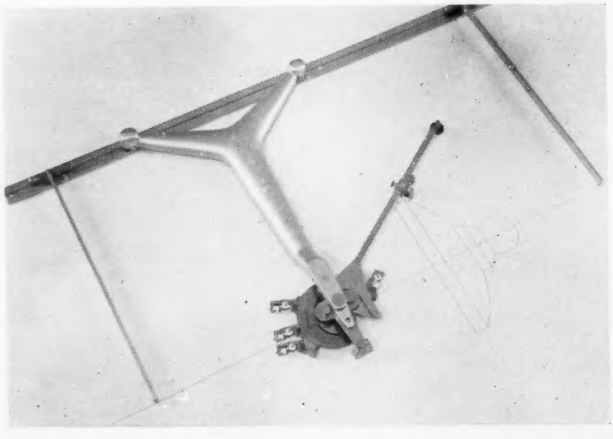
An instrument which permits the direct reading, from point to point, of the integral value of a curve while tracing it, is the integrimeter. On taking readings of the measuring roller at definite intervals, the operator is thus able subsequently to plot the integral curve at the finish of the tracing. Owing to this property, the integrimeter is a substitute for far more expensive integraphs, in the solution of problems in the domain of mechanics, (static moment, centre of gravity, moment of inertia) shipbuilding and ballistics. One important application is the formation of mean values from extended curves, such as the daily means from the weekly diagrams of water level recorders.



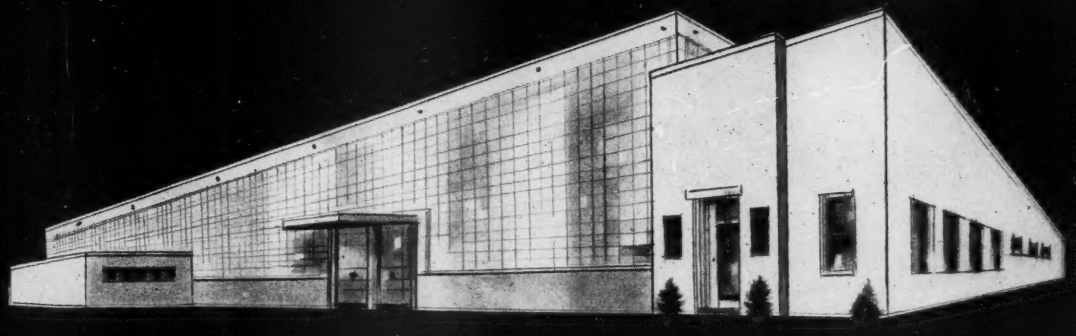
AREA-MOMENTS EVALUATOR

This new area-moments evaluator is claimed to surpass (for powers higher than 2) all existing multiple-integrators, because it works with a more convenient mathematical rule and gives each result directly and independently.

The instrument shows (with three rollers) the area $\int y\,dx$ and its moments $\frac{1}{2}\int y^2\,dx$, $1/3\int y^3\,dx$ and $\frac{1}{2}\int xy^2\,dx$ and, with a fourth roller, the moments $\frac{1}{4}\int y^4\,dx$ and $\frac{1}{2}\int x^2y^2\,dx$. The tracer arm is throughout divided and the tracing pin adjustable by micrometer screw and vernier. Length of tracer arm is 20 in. maximum deflection ± 16 in. Ruler 90 in. for a range of 67 in. No. 192 with three measuring rollers, code word PAWAT; No. 193 with four measuring rollers, code word PAWIK. ★



Here, we convert *IDEAS* to products and profits

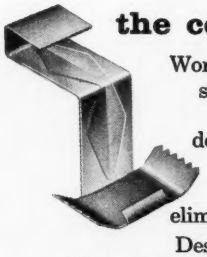


for all Canadian industry

Improved fastening methods created and developed by completely integrated Canadian company

"Imagination is given the reins" at the Hamilton plant of Dominion Fasteners Limited. Here, through a combination of up-to-date facilities and creative personnel, this Canadian company is constantly inventing, developing and producing better fastening methods for industry.

Manufacturers of the famous line of SPEED NUT brand spring tension fasteners, Dominion Fasteners Limited are always ready and able to provide any industry with an efficient and economical solution to any attachment problem.

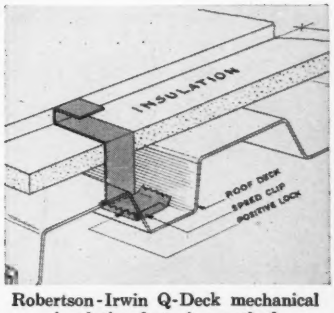


here's an example of how

the construction industry profits . . .

Working with ROBERTSON-IRWIN LIMITED, a major supplier of steel roof deck to the Canadian construction industry, Dominion Fasteners Limited created and developed a new type SPEED CLIP for the attachment of insulation to roof deck. The precarious fire hazard associated with former methods was completely eliminated . . . as well as many other installation problems.

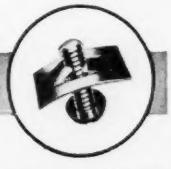
Designed and developed entirely in Canada by Canadians, this new addition to the SPEED NUT family of over 6000 types and sizes of fasteners is now being adopted in the U.S.A.



Robertson-Irwin Q-Deck mechanical insulation fastening method

TINNERMAN
Speed Nuts®
FASTEST THING IN FASTENINGS®

over 6000 types and sizes



DEPT. C

Exclusive Canadian Licensee

DOMINION FASTENERS LIMITED - Hamilton, Ontario

a Geo. A. Tinnerman corporation

Measurement of friction makes basis for research

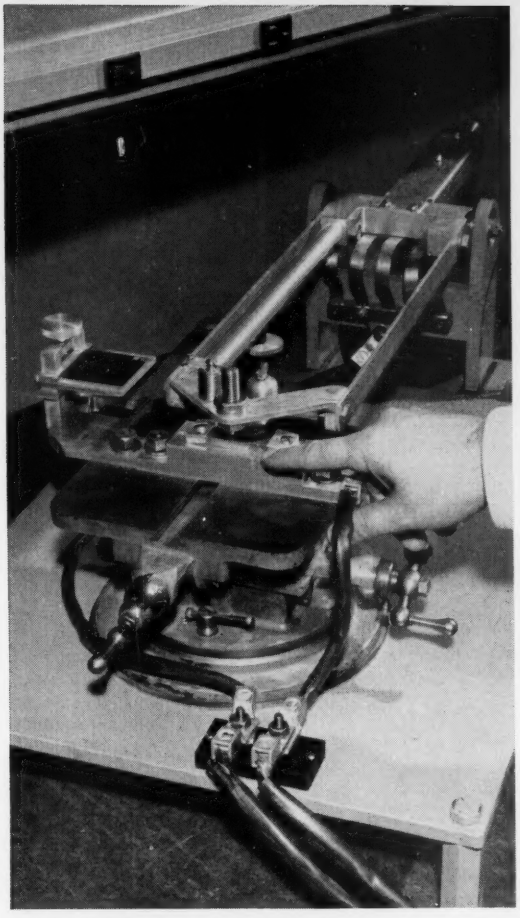
The basic laws of friction were first enunciated by Coulomb in 1785 and are still regarded as being more or less valid. These laws state that when one body rests on another the static friction, that is, the tangential force to start sliding, is (1) proportional to the normal load and (2) independent of the geometric area of contact. The tangential force to maintain sliding (kinetic friction) is generally less than the static friction. However, it is generally found that over an appreciable speed range the kinetic friction is constant.

Two main types of theories have been advanced to explain the frictional behavior of sliding solids. Coulomb attributed it primarily to the surface irregularities. In this view one surface has to be lifted over the asperities on the other and in the course energy is expended. If, as Coulomb suggested, there is no surface interaction one would expect all the energy lost in going up the asperities to be regained on coming down. This is like a frictionless car on a roller coaster: it can travel any horizontal distance without loss of energy if the final and initial levels are the same.

Energy can be dissipated only if the roller coaster has saw teeth so that after traveling up the slope the car falls catastrophically over the edge and destroys all its energy in impact. This aspect of the nondissipative nature of the Coulomb theory is rarely discussed in engineering texts.

In addition, it is generally found that over a very wide range of surface roughnesses the surface finish has very little effect on the friction between clean metals. If, however, the surfaces are very rough (e.g. if a file is pulled over another file) there is a very marked effect due to an inter-locking of the asperities. For sliding to occur the asperities must be sheared or filed away.

The phenomena that occur when solid surfaces make contact have long fascinated scientists and this interest has motivated the Stanford Research Institute to correlate and interpret an abundance of information gathered by many scientists, and to sponsor further basic research in the field. Studies are in progress in the Control Systems Laboratory relating to the following problems in surface physics: electrical contact phenomena and related catalytic effects, friction and wear, lubrication under high pressure and at high temperature, static electrification and adhesion. With the advent of transistors and other low level electronic devices,



Dr. K. R. Eldredge of the Stanford Research Laboratory has developed this new friction measurement apparatus.

the group's investigation of the cause of failure in electrical switches and relays is highly significant.

Dr. K. R. Eldredge, manager of the Laboratory, has developed a friction measurement apparatus for measuring the friction, or tangential force, which resists sliding between surfaces. Dr. David Tabor (from whose paper much of this material was taken), international fellow from the University of Cambridge, England, and Dr. Wilbur W. Hansen, senior research engineer, are utilizing this and other apparatus to measure friction of clean surfaces or those covered with suitable lubricants. A study is also being made of the effect of high temperature and of electrical current on surface damage.

With the friction measurement apparatus and other associated equipment, the following types of problem will be approached:

Reduction of friction and wear between heavily loaded sliding mechanisms.

Investigation of wear and conduction phenomena in commutators.

Development of techniques for increasing relay reliability, particularly under low-level switching conditions.

Evaluation of techniques for the determination of the adhesion between plastic laminates and metals. ★

Quotes

Points from current papers and speeches

In the study of high temperature phenomena, the arc image furnace provides many advantages, such as ease of control, stability, reproducibility and moderate size and cost. While a certain amount of the discussion given in this lecture by **T. P. Davis** at the high temperature symposium sponsored by Stamford Research Institute is applicable to high intensity arc discharges in general, only the high current carbon arc was treated specifically. Hence, it will be of some interest to discuss this source, particularly those features which have direct bearing on the problems of arc image furnaces.

The earliest form of high current carbon arc was developed by Beck about 1914, and employed a positive carbon, cored with cerium fluoride and oxide, operated at current densities of 100 to 400 amps per sq cm. Finkelnburg determined that the cerium compound core was not a necessary condition, and that many kinds of positive carbon could be employed, provided the anodic current density was sufficiently high. This led to the characterization of a general high current arc, with certain properties among which are: (a) anodic current densities from 100 to 400 amps per sq cm, and (b) a rather deep positive carbon crater filled with brilliant, high temperature vapor, ejected from the base of the crater. While other properties are of considerably more importance with respect to the fundamental mechanism of this discharge, these two are of most direct concern in an imaging-type furnace. First, because of the high current densities required, the majority of high current arcs in practical application employ positive carbons of 16 mm diameter or less in order to limit the power requirements to a reasonable value. Secondly, while the positive carbon crater is thus somewhat limited in area, it presents a source of extraordinary brilliance. The principal source of irradiance is not an incandescent carbon tip, as in the low current arc, but rather the high temperature vapors within the positive crater. A total radiation of over 6 kw per sq cm of crater cross-section can be attained, corresponding to that from a black body at 5,800 deg K.

• • •

Car of the Future

In a recent banquet address at the semiannual meeting of the ASME, **Arch T. Colwell** expressed the opinion that gas turbine-powered automobiles will be coming off the production lines as present production equipment requires replacement. They will probably appear one model at a time, since the job of retooling will cost millions of dollars. Gas turbines will appear on automobiles before they appear on trucks and other commercial vehicles because they offer the industry a new selling point.

Fuel-injection systems for piston engines will come even before the gas turbine. These, too, will create a selling point, since they will eliminate the carburetor and the air filter, making it possible to lower the hood and restyle the front end.

Changes in suspension systems are "right around the corner." Springs and shock absorbers will give way to hydraulic and pneumatic cushions.

• • •

Nuclear Heat Engines

Five to ten years ago, few people would have predicted that in 1956 engineers would be building nuclear power plants of 100,000 to 200,000 kw, or that by 1970, 25% of all new public utility power plants will be nuclear power plants. In England, where the cost of fuel is high and the shortage of both domestic petroleum and coal is acute, the rate of growth of nuclear power plants may exceed that of the United States. Therefore, it may not be out of place to look at the question of nuclear powered vehicles at this time, stated **F. L. Schwartz** and **H. A. Ohlgren** of the University of Michigan, in a recent SAE paper.

Nuclear heat engines can be considered as power plants for vehicles, locomotives, aircraft and ships. Currently, about 25% of the total energy consumed in the United States is for the operation of automotive power plants.

Some interesting questions come to mind. How small would a nuclear power source be? How much shielding is necessary? Could one buy an automobile, with its supply of fuel adequate for the life of the car included in the purchase price of the car? How much will nuclear fuel cost? Will enough of it be available? How will it be produced? What is to be gained, in the way of car performance, by having a nuclear power plant?

It is conceivable that a nuclear power source could be very small if only the fissionable material needed to be considered. If the average life of a vehicle is 160,000 miles, the average speed 40 mph, the average horsepower 25, and the average hydrocarbon fuel cost 2.5 cents per mile, then the total cost of fuel for the life of the vehicle is $4,000, and the energy used is 100,000 hp-hrs. One gram of U-235 is capable of producing 1,000 kw hrs. In addition to requirements for critical mass for a given geometry and fissionable atoms necessary to overcome neutron losses to absorbing materials, about 300 gm (2/3 lb) of nuclear fuel is required if used in an engine of 25% efficiency for the life of the vehicle. To compete with the cost of hydrocarbon fuel at 2.5 cents a mile for the conditions mentioned, the nuclear fuel's cost must approximate $13 per gm.

• • •

Product Design Costs

Speaking at the semiannual meeting of the ASME **Lad J. Bayer,** chief industrial engineer of the Warner & Swasey Company, Cleveland, presented a set of charts tabulating the cost differentials for different standards of dimensional tolerance and surface roughness.

He limited himself to data readily available in his own company, but stated that the technique of plotting design features against their respective costs can be expanded into other manufacturing fields. The design engineer's main task is to attain as nearly as possible a balance between the function, durability, appearance and cost of a product.

• • •

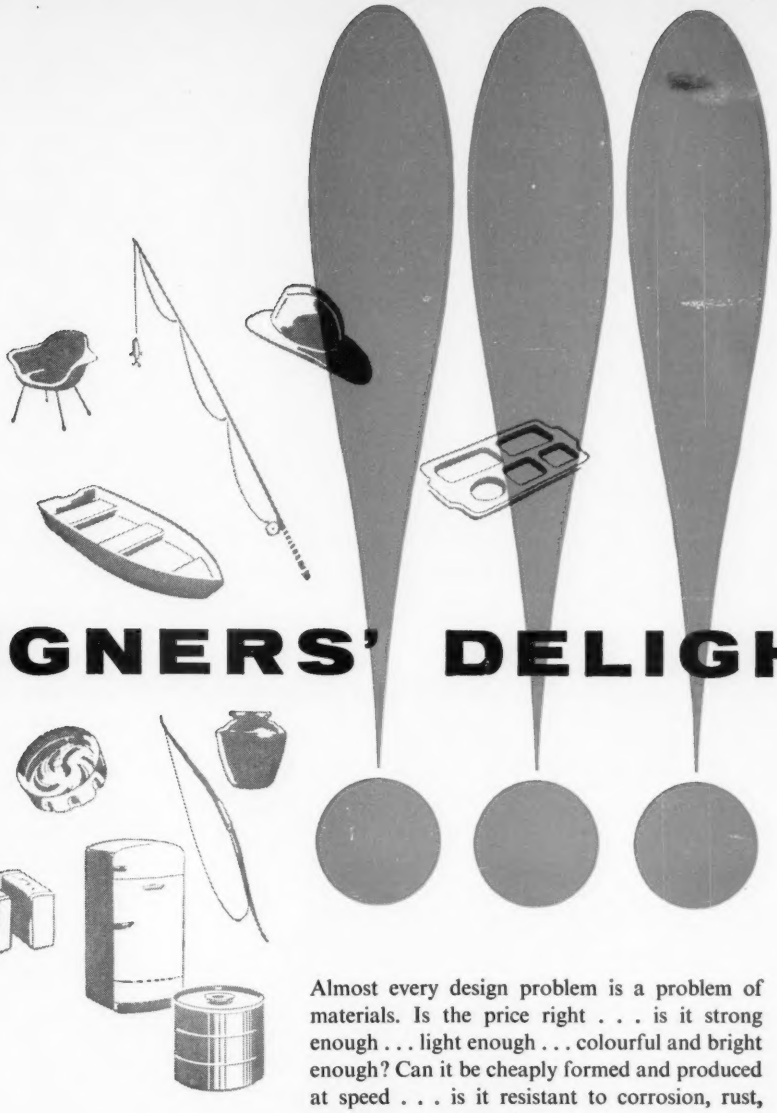
Selecting Machine Tools

An engineer has devised a means for taking 10 variables, such as initial cost, space requirement, depreciation, hourly wages and power consumption, and feeding them into a single formula that will tell management whether and how it ought to select new machine tools.

The formula, expressed as a nomogram, uses such different dimensions as dollars, square feet, percentage and kilowatt hours. It was presented at the semiannual meeting of the ASME by **Realf Ottesen**, senior designer of McCulloch Motors Corporation, Los Angeles.

The system was originally put into practice when the speaker was research head of the Motor Engine Manufacturers Institute at Trondheim, Norway. It was used to set up general rules for the retooling program of Norwegian motor manufacturing plants.

The nomogram not only allows management to determine, from the swivel chair, which machines should be replaced and how much their replacements would cost, but can be used to indicate the company's status in terms of expenses, price level, trend of wages and salaries and the cost of modernization. It can be further extended to take in groups of tools and to condense the cost of an entire factory into a single, although necessarily more detailed, nomogram. He said complete factory cost levels showing profits can be made at a moment's notice.



DESIGNERS' DELIGHT

Almost every design problem is a problem of materials. Is the price right . . . is it strong enough . . . light enough . . . colourful and bright enough? Can it be cheaply formed and produced at speed . . . is it resistant to corrosion, rust, denting or scratching?

That's why so many design problems simply cease to exist when the designer begins his planning with a full appreciation of what can be done with Fiberglas Reinforced Plastics.

F.R.P. could be the answer to your problem

FIBERGLAS*
FIBERGLAS CANADA LIMITED

FIBERGLAS CANADA LIMITED
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10 PRICE STREET, TORONTO, ONT.
BRANCH OFFICES:
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IT'S AMAZING THE DIFFERENCE FIBERGLAS MAKES!

Die castings

(Continued from page 59)

holes can be cored; it is produced at higher rates with less manual labor, has smoother surfaces and commonly costs less per die casting.

Forgings: Die castings can be more complex in shape; can have shapes not forgeable; can have thinner sections, can be held to closer dimensions and can have coring not possible with forgings.

Plastic Moldings: Die casting is much stronger; can be produced faster and in more complex shapes; usually involves lower tooling cost; is much more stable dimensionally; can be held within closer dimensional limits and can be finished, as by plating, in ways that are not feasible (or slower) with plastic moldings.

Typical applications

The chassis of the new Westinghouse miniature portable, encased in polystyrene plastic, is supported by the frame which is shaped like a wide U. Attached to the frame (see illustration) is the die cast base sectioned off by thin interal walls, to house the batteries, and easily detached from the base for battery replacement. Depressed lettering cast into the base attractively spells out the name. The dial, with a serrated edge at its perimeter perpendicular to the dial plane, is also a zinc die casting. Calibrated numbers are cast-in as depressed lettering.

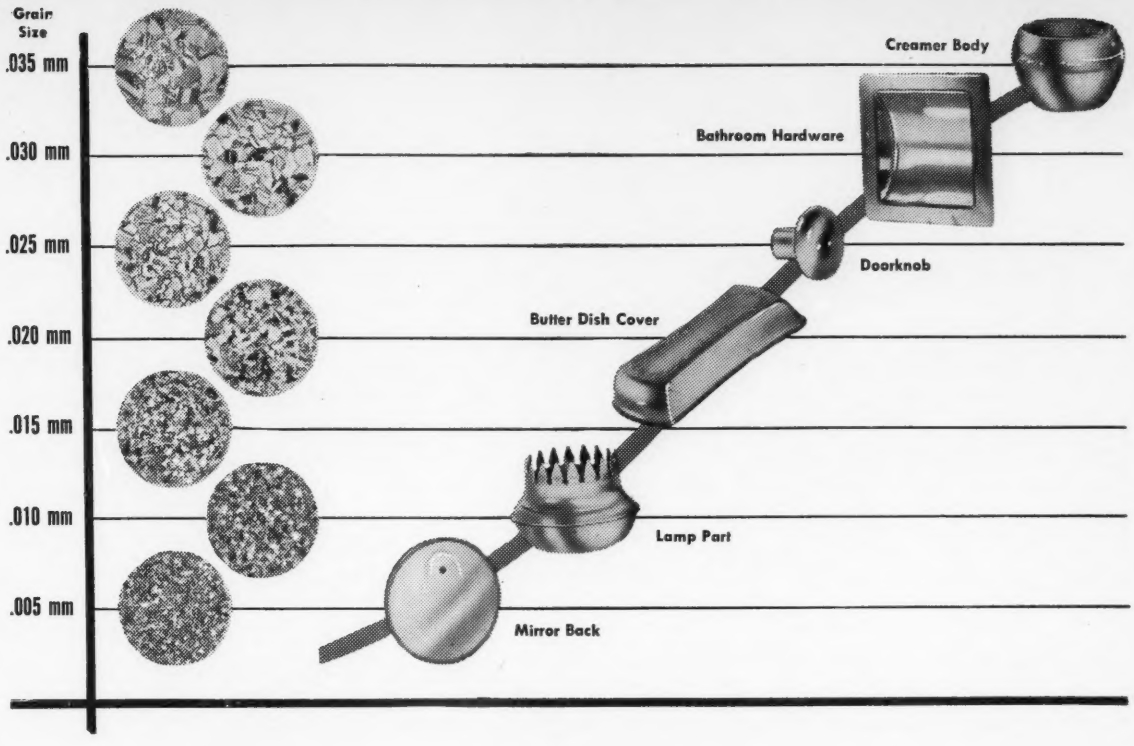
Die casting's ability to produce a smooth surface finish was a major consideration in specifying the process because these die castings had to take a "jewelry" finish. In fact, all the die cast parts receive a brass satin lacquer finish. The depressed lettering on the dial and base is blacked-in, resulting in a handsome black and gold combination that adds to the radio's appeal.

A combination three-cavity die is used to produce the three parts. Except for two 1/16 in. holes which are tapped, all dimensions are cast to size in these two die castings.

By working closely with their job shop die caster, Westinghouse engineers were able to get components meeting rigid specifications at the most economical cost.

Denison Corporation design engineers devised a window operating mechanism that motivates all windows in one casement simultaneously by the turning of a single handle. Certified zinc die castings were specified for the entire mechanism, including hand crank, drive gears and gear housing, window hinges and hinge brackets (see illustration). The high strength of die cast zinc and its equally important ability to hold close tolerances in bearing recesses despite the corrosive action of all types of weathering, was the basis for its selection in these components.

(Continued on page 72)



Which is the RIGHT Fine Grain Brass for a Job?

Write for a free copy of this folder on Grain Size— "The Fourth Dimension."

High finish on decorative brass can be produced at much lower cost by using a fine grain metal. But severe cupping, drawing and forming operations require ductility which decreases, generally, as grain size gets finer.

The right metal for the job, then, is often a compromise between fineness of grain and ductility: *no one fine grain brass can do all jobs well.*

By offering a *range* of grain sizes, Noranda can supply you with the *right* fine grain brass for every application, assuring you optimum production at lowest costs.

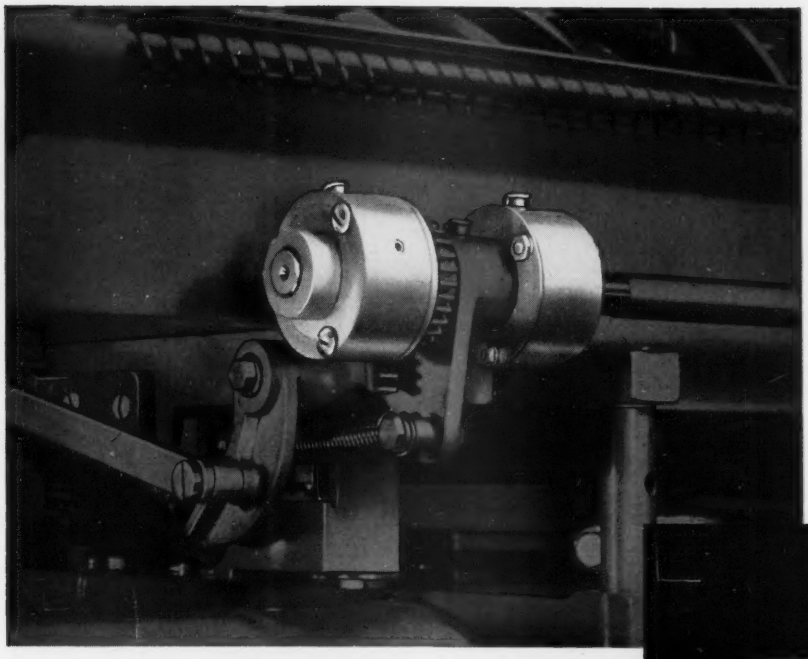
Noranda Technical Service will be glad to work with you in finding the right brass for your product if you will contact them through your local Noranda Sales Office.

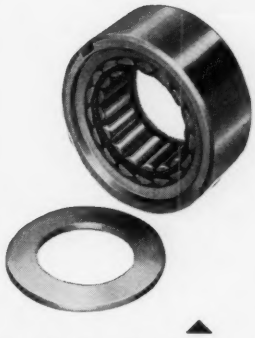
COPPER Noranda BRASS

Noranda Copper and Brass Limited

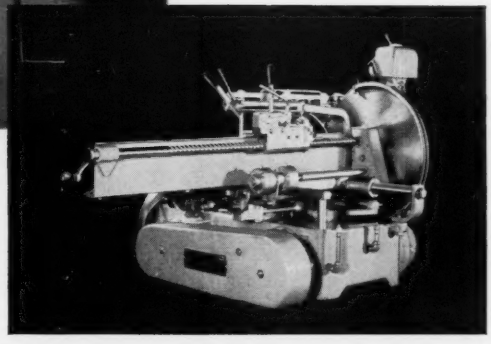
SALES OFFICES: MONTREAL • TORONTO • WINDSOR • EDMONTON • VANCOUVER

Morse Cam Clutches make slicing machine infinitely more accurate





Series 200 Cam Clutch with retaining end plate removed. This Cam Clutch Series fits standard Series 200 bearing housings.



Here's how they work:

The first Morse Series 200 Cam Clutch controls indexing (though not required on this job, it can handle up to 500 indexes per minute). When driven in one direction, inner and outer members rotate as one unit. When driven in the other direction, one member overruns freely, other member remains stationary. The second Cam Clutch is used to prevent backfeed between strokes.

Versatile, compact clutches can help designers control indexing, free-wheeling, backstopping

This modern slicing machine is infinitely more accurate because a Morse Cam Clutch replaces the old ratchet and pawl mechanism controlling the feed.

When U.S. Slicing Machine, Inc., used the ratchet and pawl, feed variations (slice thickness) could only be made in 1/128-inch increments. Now, the Morse Cam Clutch provides, in effect, a self-contained ratchet with an infinite number of teeth . . . and literally makes it possible for the machine to slice accurately to *any* desired thickness.

In addition, another Morse Series 200 Cam Clutch is used as a backstop device to maintain one-directional drive. It instantly engages to prevent backfeed between forward strokes.

Morse Cam Clutches are manufactured in capacities ranging from 4½ inch-lbs. to 20,000 ft.-lbs. Their low-cost accuracy and dependability make them ideal for a wide range of industrial indexing, overrunning, and backstopping applications.

Like other precision-built Morse power transmission equipment, they are quickly available from your local Morse Distributor. For more information, or free Catalog C 11-54A, call him, or write us today. **MORSE CHAIN OF CANADA LTD., SIMCOE, ONTARIO**

MORSE

PRODUCTS OF BW BORG-WARNER

CHAINS, CLUTCHES, AND COUPLINGS

File

New booklets and books written for you

A new, six-page, illustrated brochure on the leak detector is now available from **Beckman Instruments, Inc.**

Bulletin 483, contains the latest technical data of this versatile instrument, as well as information on many applications. It has been designed to locate minute leaks in pressure, vacuum and hermetically sealed systems and units.

Covered in the brochure are methods by which leaks may be detected, particular applications of interest and instrument specifications. Descriptions of accessories available for use with the leak detector are given also. (200)

• • •

Constant delivery pumps

Twenty-one different sizes of Type C constant displacement, radial piston pumps built by **The Oilgear Company** are described in a new bulletin 46000. Construction, operation, speeds, capacity and pressure ratings are included.

These constant delivery pumps are used individually on small and medium presses, on calender hold-down systems and with variable displacement motors to provide variable speed, constant power drives. These pumps are also used in series with other constant displacement pumps, or in combination with variable displacement pumps. They are extensively used in the iron, steel, metalworking, plastic, automotive, rubber, printing, paper, lumber, food, chemical and textile industries. (201)

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Test equipment

In a catalogue just published by **The Narda Corporation,** a complete line of coaxial and UHF equipment, microwave test equipment, bolometers and thermistors is covered. Text, specification tables and photographs describe existing equipment and such recent additions as fixed and variable attenuators, high power impedance meters, tees, fixed and sliding terminations and UHF coaxial directional couplers. (202)

• • •

Snap action thermostats

A condensed catalogue listing physical, electrical and performance specifications for many types of snap-action, locally adjustable thermostats is offered by **Fenwal Incorporated,** manufacturer of precision temperature controls.

The four-page, two-color catalogue describes in convenient pictorial and tabular form the assortment of head styles, snap switches, electrical ratings, temperature ranges and modifications for the Series 20000 Thermoswitch, by which the user can specify a thermostat exactly suited to his requirements.

The catalogue also presents general information about snap-action thermostats and discusses the various installation and service factors affecting temperature control, regardless of the type of controller used. (203)

• • •

Corrosion resisting steel castings

A new designation chart (Bulletin 556-C) for corrosion resistant stainless steels has been issued by **Empire Steel Castings, Inc.** The chart identifies ACI and Empire designations with the corresponding AISI type number, the ASTM designation and with other designations and trade names. This correlates the various stainless types for easy selection and reference.

The new chart also gives the percentage of principal alloying elements and typical mechanical properties for the twenty-three steels listed. Helpful remarks indicate the application and performance of many of the steels in use.

As a further guide to alloy selection, the chart includes a graph showing the effect of individual elements on corrosion penetration rate and also a graph showing the resistance of cast alloy type CF-8 to various concentrations of nitric acid as a function of temperature. (204)

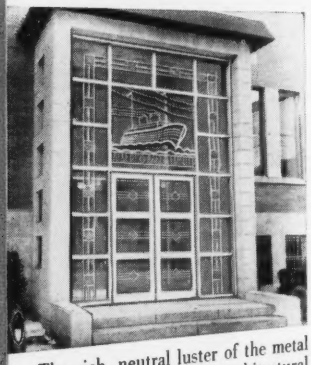
• • •

Oil-Hydraulic systems

A new 20-page two-color illustrated catalogue (Bulletin M5101A) describing oil-hydraulic systems and components for all mobile equipment in the truck and bus, construction machinery, material handling, agricultural and allied industries is now available from **Vickers Incorporated.**

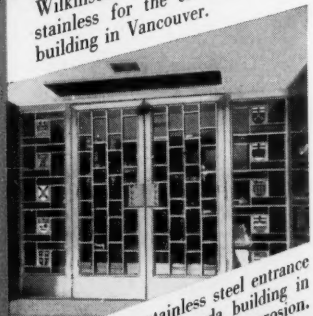
The new catalogue contains discussions of performance characteristics, design features, construction details and applications for their line of single and double vane pumps, power packs for mobile equipment, multiple unit valves, relief valves, reservoirs, fluid motors and power steering boosters. Each section includes photographs, cutaway views and all the relative performance curves. (205)

Entrance to the Fairbanks-Morse building in Winnipeg.



The rich, neutral luster of the metal contributes to handsome architectural effects as illustrated in the Albert G. Baker Limited building in Quebec City.

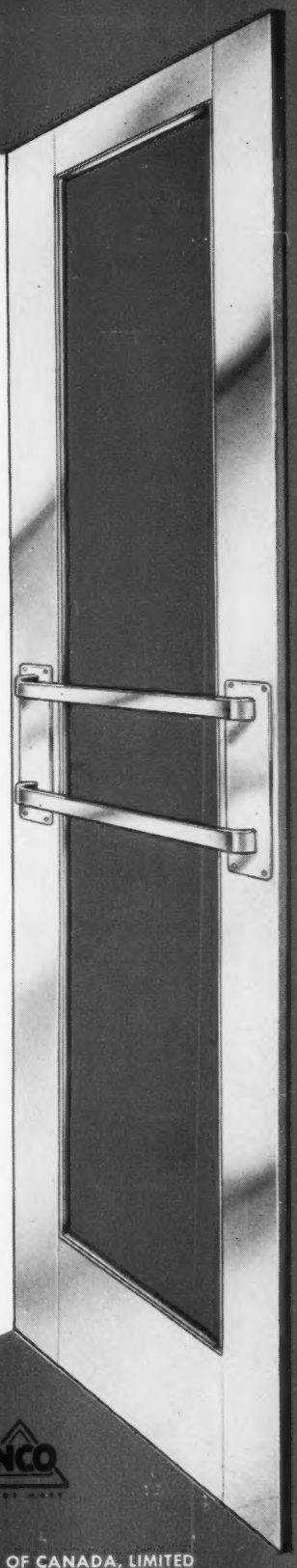
Wilkinson Company Limited chose stainless for the entrance to their building in Vancouver.



This modern stainless steel entrance to the Bank of Canada building in Winnipeg resists rust and corrosion.

From coast to coast... entrances to be proud of...

...with nickel-containing stainless steel



THE RICH, NATURAL BEAUTY OF STAINLESS IS LONG LASTING—ECONOMICAL TO MAINTAIN

Architects and designers have found that stainless steel is an enduring construction material that does not deteriorate with age and exposure. Stainless is easy to keep clean, cuts maintenance time and costs. But, above all, stainless steel is a decorative material that gives buildings grace and dignity . . . pleasing and unobtrusive beauty.

INCO

THE INTERNATIONAL NICKEL COMPANY OF CANADA, LIMITED

25 KING ST. W., TORONTO, ONT.

Die castings

(Continued from page 66)

To reduce weight, maintain low production costs and modernize their standard typewriter Model 150, engineers of the Underwood Corporation have effected a major product improvement with a one-piece aluminum die cast main frame, which replaces the former assembly of six iron sand castings. The immediate advantages of the changeover are obvious: (1) rigidity of the frame — markedly increased; (2) weight — 4½ lb less; (3) assembly of the frame — eliminated; (4) machining of the frame — almost eliminated; and (5) many assembly fasteners and other small parts — eliminated.

Add to these savings one of the major advantages of die casting — its ability to produce metal components with a very smooth surface. The design and production of a dense, nonporous, smooth die cast frame eliminated the need for a primer coat in the finishing process.

Die cast aluminum (ASTM Spec. B85-52T, Alloy SC 84A) was specified for the frame because of its great characteristics combined with lightweight. Many cores in the single cavity die provide the frame's various undercuts and intricate shape. These walls, characteristic of die casting, are a key factor in keeping the weight down on each of the 120,000 frames produced annually. Unique in die casting practice is the retention of the casting's "gate" throughout the machining cycle, to provide extra rigidity and to ensure dimensional accuracy. Afterwards, the gate is removed in a simple punch and die.

The one-piece die cast frame gives this typewriter a "built-in" strength and dimensional stability that eliminates variations often occurring in assemblies. ★

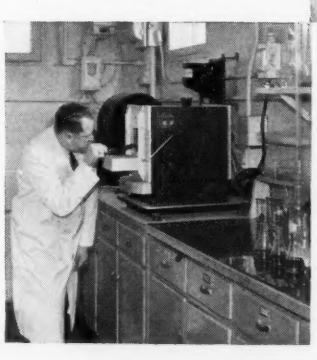
The Proof of Quality

STAINLESS STEEL

From the balanced blending of metals to the close and careful inspection of the finished casting, 'Shawinigan' laboratory control produces the finest stainless steel in Canada.

This 'Shawinigan' *full control* is your proof of quality . . . your guarantee that 'Shawinigan' Stainless Steel corrosion and heat resistant castings meet every rigid specification for uniformity, longer life and carefree service.

For a quarter of a century, 'Shawinigan' has pioneered the production of superior Stainless Steel for your particular requirements. Investigate the possibility of saving money in your business with 'Shawinigan' Stainless Steel corrosion and heat resistant castings.

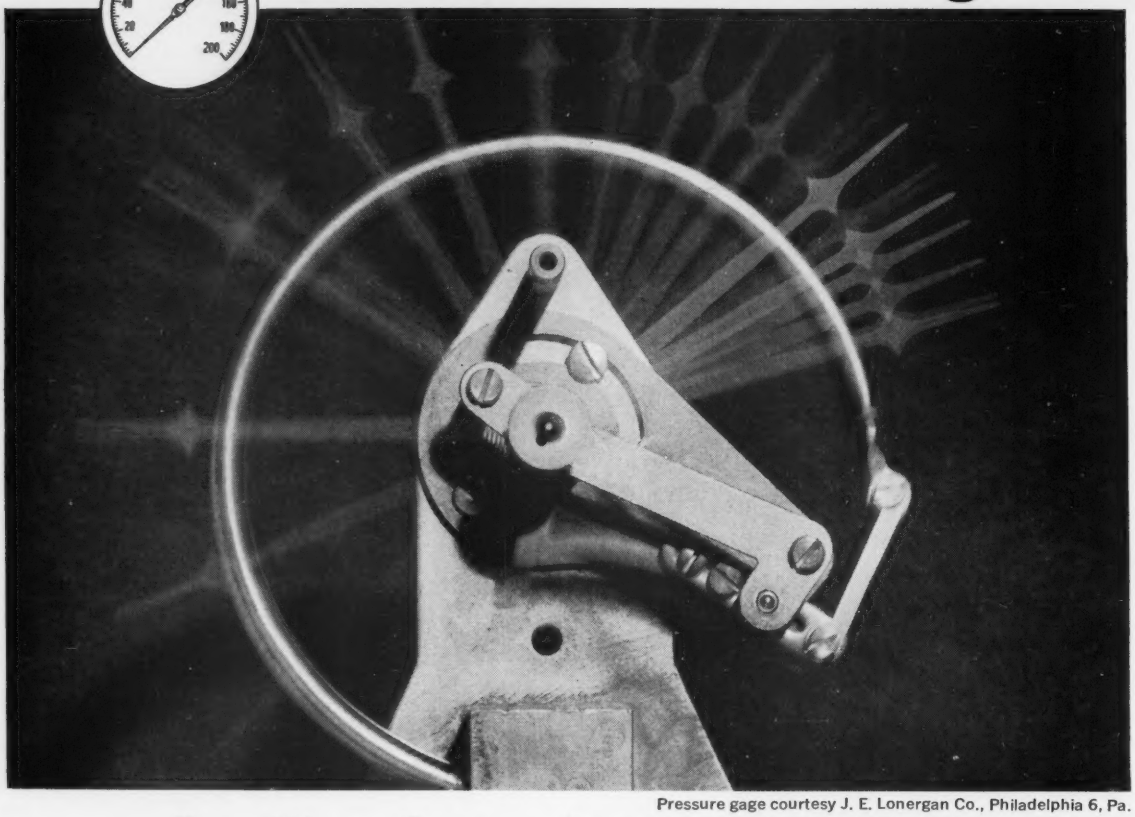


SHAWINIGAN CHEMICALS LIMITED

Stainless Steel and Alloys Division

Head Office: Shawinigan Building, Montreal, Que. — Plant: Shawinigan Falls, Que.

Non-Habit-Forming



Pressure gage courtesy J. E. Lonergan Co., Philadelphia 6, Pa.

Beryllium Copper Tubing by Superior

This unusual term describes perfectly one of the most important properties of beryllium copper tubing. The Bourdon tube shown above is an excellent example. Once the beryllium copper tube is in the gage, it "remembers" its job and acquires no new habits. It yields constantly to pressure and as constantly returns to its original position without taking a new "set."

Beryllium copper tubing by Superior has this and many other important characteristics to a marked degree, such as hardenability, corrosion and fatigue resistance, thermal and electrical conductivity. It is easy to fabricate, it is nonmagnetic.

Beryllium copper tubing lends itself to a wide variety of applications. It can be severely worked to form convoluted flexible waveguides and bellows. Cold drawn to specifications, followed by proper hardening, it makes an excellent aircraft antenna, with the strength to withstand thousands of hours' vibrating in 100 mph winds. Used as a contact roll in a business machine collator, it is wear and corrosion-resistant, and a good electrical conductor. Or, as above, shaped for use as a Bourdon tube, it is tough, ductile, durable—and holds its original shape.

Superior produces tubing in over 63 analyses . . . in stainless, alloy and carbon steels, nickel and nickel alloys, beryllium copper, titanium and zirconium. Let Superior's tubemanship and experience help you solve your tubing problems. You'll like the service and the products—they *are* habit-forming. Send for your free copy of Data Memorandum No. 7 on beryllium copper tubing. Write Superior Tube Company, 2031 Germantown Ave., Norristown, Pa.

Superior Tube

The big name in small tubing

NORRISTOWN, PA.

All analyses .010 in. to ⅜ in. OD—certain analyses in light walls up to 2½ in. OD

Lyman Tube & Bearings, Ltd., Montreal, Toronto and Winnipeg
Alloy Metal Sales, Limited, Montreal, Toronto and Winnipeg
Robert W. Bartram, Montreal

Book Department

Handbook of fastening and joining of metal parts.

One of the basic keys to mass production is an intimate knowledge of how to fasten parts together. Efficiency depends not only on how fast and cheaply a part can be made, but also on how quickly a product can be assembled.

Yet few books have been written on the subject of fastening and joining and those that have are either directed to the production engineer or confined to one specialized technique. In only a few has information issued by technical societies and associations, such as the ASME, SAE, AWS and others been correlated for the designer. In none have standards been supplemented with solutions to fundamental problems of joining and assembly. In this volume the authors, **Vallory H. Laughner** and **Augustus D. Hargan,** have attempted to overcome such deficiencies.

The ultimate aim has been to provide the design engineer with both a reference and an idea source covering all known methods of joining metal parts. The production engineer should also find the book of value, if only from the standpoint of how to redesign to minimize assembly problems. Information on production methods, machines, jigs and fixtures has, however, been included only when necessary to establish clearly the advantages and limitations of any one technique or fastener.

The first section covers fundamentals of various fasteners and fastening techniques. The approach in each chapter is different because the techniques are basically unrelated. Thus, the chapters on threaded fasteners consist mostly of descriptions of standard types, guidance on where they can be used and tables of established sizes. The chapters on welding and brazing, on the other hand, cover the advantages, limitations and application for each welding and brazing method; recommended joint design; and types of materials and products to which each technique can be adapted.

The second section — the Supplement — is based on the principle that no designer has difficulty in calling to mind several methods of fastening, say, glass to metal . . . or a number of low cost shaft couplings . . . or a few ways of joining sheets without fasteners . . . but that none will remember a score of ways of accomplishing each objective. The solutions to such problems are presented in sketch and caption form in the hope that each page will provide a refresher and an idea reference for engineers in all phases of industry.

The book is published by McGraw-Hill and the price is $18. It should prove an invaluable source of reference and make a worthwhile addition to your shelves.

Sampling switches

(Continued from page 39)

ground station equipment then reverses this procedure so as to separate, identify, and/or record the transmitted information. Close synchronization must constantly be maintained between the ground and airborne equipment placing emphasis on accuracy of duty cycles and sampling rates.

Airborne and missile applications have divergent requirements. An expendable, low-cost, medium life switch is usually required for the smaller missile evaluation tests. A typical 2 pole, 30 channel 5 rpm expendable unit, complete with a 28 or 6 volt dc magnetically shielded PM motor is illustrated. A precision worm reduction and separate completely shielded RF filter is included.

On the other hand, recoverable missile programs require extensive ground testing and as with airplane flight testing, require longer life, serviceable units. Figure shows a special hermetically sealed, 6 pole, 12 channel, 400 cycle AC motor driven switch.

The current impetus in missile and airplane advancement is constantly increasing the severity of the environmental specifications required.

The shock, acceleration, vibration, altitude and of course the ambient temperatures specified impose strict limitations on materials and on switch packaging.

The single gun, cathode ray oscilloscope's usefulness can be greatly expanded by the effective use of time-sharing techniques. Common applications include the simultaneous display of the outputs of up to 100 or more signals, such as, tube characteristic or transistor curve displays radar, navigational and fire control systems.

In each case, a large number of different input signals are connected to a single gun oscilloscope at a high sampling rate so as to make them appear simultaneous and to prevent the appearance of flicker. A sampling rate range of from 5 to 10 rps is normally used.

Shown is a 6 pole, 45 non-shorting channel unit provided with a dynamic phase adjustment feature. This type of unit is particularly useful in the early stages of system development as it allows phasing and wiring to be frequently changed without necessitating disassembly of the switch. Uuually, if the system goes into production, a transition is afforded into a precision fixed phase, Inside-Out switch construction for the resultant savings in space and ease of servicing.

One is tempted to use the much discussed term, automation in describing the broad scope of switch applications to industrial instrumentation. Many of

the applications mentioned in this article under other headings are also used industrially.

With the current trend of increasing mechanization and feedback electronic control of complex processing equipment, the effective utilization of time sharing techniques provides appreciable savings in equipment, space, and cost.

Requirements for amplifying recording, displaying or simulating the output signals from banks of transducers, are frequent. Sampling switches provide a practical answer for time-sharing the expensive and bulky equipment required. New, lower cost designs have been made available in answer to the constant demand for increased economy.

Since long life is consistently a requirement, unusual stress is placed on ease of access and servicing.

A single, specially designed 2 pole switch can be used to advantage to chopper stabilize a bank of high gain dc amplifiers. The switch continuously samples the input and output of each amplifier in turn, compares them and then automatically applies the corrective signal necessary. One switch can thus replace as many as 100 choppers and their associated balancing amplifiers, affording increased economy, reliability, as well as reduction of the space required.

Precision computers require unusually long total lives of 10,000 hours or more as many are operated continuously 24 hours a day, seven days a week. In such applications, reliability, freedom of access and simple servicing are important.

Down hole logging of oil wells is a rapidly growing field. A common means for checking or predicting the performance of an oil well is electronically to measure and record the earth resistivity, potential or electrical field variations. It is interesting to realize that since space is limited, no cooling can be provided. Hence, in the deeper wells, the environmental temperatures may be as high as 300 F or higher.

Switches mounted with the measuring instruments are lowered into the well and are used to time-share the miles of cable and the recording equipment located topside.

The continued technical advance in high speed rotary switch design provides a reliable, high performance new component to tax the ingenuity of the design engineer.

It is hoped that this article will lend encouragement to the application of high speed switches to meet new requirements. Suitability to low level applications, dependability, small size, long service-free life and simple servicing make sampling switches the preferred means for low frequency time-sharing duties. ★

Loudspeaker

(Continued from page 49)

A tandem permanent magnet assembly is used. The circumferential surface of the centre plate provides a good position for supporting the overhanging mass of the speaker unit when mounted in a cabinet. Due to the separate airgaps for the LF and HF sections of the magnet assembly, and the low reluctance common flux path in the centre plate, electro-magnetic intermodulation is negligible. Alcomax II magnet material is used which results in gap flux densities as follows:—

	LF	HF
Gap flux density (gauss)	14,300	12,700
Total flux (Maxwells) .	285,000	48,000

These flux values, in conjunction with the moving coil and diaphragm details, provide a balanced output from the relatively high efficiency horn-type HF unit and the direct-radiator LF diaphragm.

The conventional frequency/intensity response curve can be misleading with regard to the expected subjective results when a listening test is carried out. A method of delayed resonance response measurement has therefore been used as a method for determining the frequency response characteristic of the speaker.

A train of waves having a square envelope of a selected frequency is applied to the moving coil of the speaker, and the resultant sound intensity is measured at the time of the signal and at suitable intervals after the electrical input has ceased. Measurement is carried out by a microphone with amplifier and a suitable presentation measuring unit, such as a cathode ray oscilloscope.

Tests were carried out under conditions where reflected energy from the surroundings was so low that it did not appreciably affect the readings.

The response of the loudspeaker, particularly at the bass end of the audio range, is dependent to a large extent upon the conditions of mounting. BTH provides a suitable bass reflex cabinet in wood with an internal air volume of 7 cu. ft. and grill which is both decorative and relatively non-absorbent to the high audio-frequency output. ★

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New products & materials

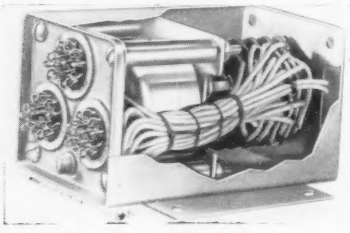
New items which can help you on the job

Hermetically sealed, moisture and dust proof Ledex rotary selector switches and stepping relays have been developed by **G. H. Leland, Inc.**

The switches and relays, which are applicable in the automation, electronics and aircraft fields, are protected from the effects of salt spray, fungus and humidity.

Both are hermetically sealed in an inert atmosphere of dry nitrogen with a slight addition of helium tracer. Sealing is to test No. 1 of MIL-R-25018.

This type of installation protects against any tampering with the contacts or the relay mechanism. It also prevents shock or injury to personnel.



Where no mushrooms grow

This hermetically sealed package is available in several standard enclosure sizes. Standard hermetically sealed switches are available with a maximum of four wafers and 105 pins in the header. (206)

• • •

Portable Spacing Comparator

This instrument checks the spacing on flat and circular thread rolling dies, thread chasers, circular and flat form tools, wheel crusher rolls, gear racks, broaches, aircraft parts, such as turbine blades, and checks the location of forms from their locating face or surface as well as inspection on all threaded products. It is made by the **Jerpbak-Bayless Company.** (207)

• • •

Paste type brazing flux

A new paste type flux for high temperature brazing of stainless and other high alloy steels is now available from the Stainless Processing Division of **Wall Colmonoy Corporation.**

Called Nicrobraz Flux, the new material cleans and promotes wetting of the surfaces to be joined and helps dissolve oxides during the brazing action. The oxidation protection accomplishes four important brazing objectives: (1) it contributes to production of better joints on stainless steels, particularly when brazing difficult alloys such as Inconel X and other special alloys containing elements that place them high in the electromotive series; (2) it permits high temperature brazing with an oxy-acetylene torch and without special atmospheres; (3) it permits use of less expensive atmospheres when furnace brazing stainless steels and high chromium alloys; and (4) it permits the brazing of titanium or aluminum bearing stainless alloys in hydrogen atmospheres. (208)

• • •

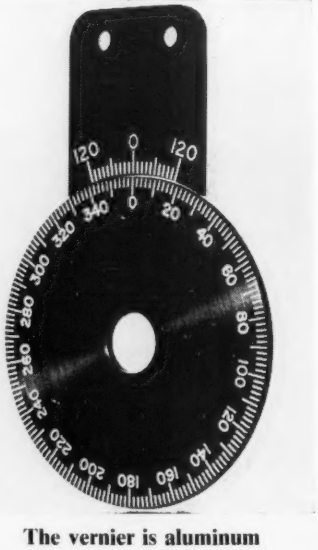
Disc Dial

Precision engraved disc dial and vernier sets are available from **Pic Design Corp.** in 4 ranges of diameter 1½ in., 2 in., 3 in., and 4 in. The complete set consists of the disc dial and vernier, which allows reading within an accuracy of 6 minutes.

The vernier sets are made of aluminum and are finished black anodized to military specification. The engraving is filled with white.

Stock standard units are engraved in 1 deg. steps reading from 0 to 360 deg.

Type K1 and K2 stainless steel hubs are also available from stock for assembly to these dials, thus offering a wide range of availability of bore sizes. (209)

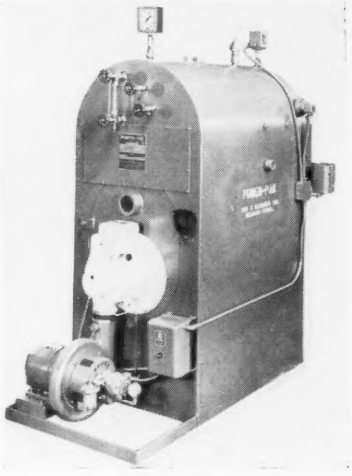


The vernier is aluminum

Low-Pressure Boiler

The low horse-power field has been entered by **Orr and Sembower, Inc.** with a compact, rugged packaged automatic low-pressure boiler for oil and gas firing that embodies top engineering features of its well-known Powermaster units for heavier industrial use.

The new Power-Pak is designed to provide steam or hot water heating or hot water service with power demand of 10, 15, 20 and 25 hp. Thus it may be used in such applications as smaller schools, office buildings, apartments, greenhouses, hospitals and churches. It is also intended for auxiliary use in large industrial plants and warehouses.



Bath anyone?

It is the only unit of its type and capacity that meets ASME standards of 5 boiler hp per sq. ft. of heating surface throughout its full range.

It is described as the first low-priced, packaged automatic boiler, in this horsepower range, that has the rugged construction and precision engineering of industrial boilers. It is fully firetested and guaranteed before being shipped. Like the Powermaster, it can be equipped with either oil or gas firing equipment. (210)

• • •

Self-tapping Studs

A new double-ended stud that cuts its own thread when driven in an ordinary drilled hole, and locks securely in the same operation, has been announced.

Know as the Schweppe stud, it is a product of the **Pheoll Manufacturing Co.,** makers of screws, bolts, nuts and industrial fasteners.

Further, it is claimed that this stud is the only commercial stud which can be automated. This is because it can be located accurately from the slotted end to permit hopperizing for automatic feeding and driving of studs.

The studs can be installed at high speed with a normal power stud driver. (211)

① HIGH STABILITY CARBON RESISTORS
Available in 1% tolerance ohmic values from 10 ohms to 100 megohms, and in 6 physical sizes. The Welwyn Panclimatic coating assures a long stable life under the most severe service conditions. Manufactured in Canada.

② VITREOUS ENAMELLED CAPACITORS
A new tropicalized capacitor, completely vitrified both as to dielectric and coating. The Welwyn Vitricon features a low power factor and an operating range up to 150°C.

③ GLASS ENCLOSED HIGH VALUE RESISTORS
A glass enveloped hermetically sealed resistor for use where resistance values up to $10^{12}\ \Omega$ are required.

④ METAL FILM RESISTORS
A true gold-platinum film resistor with a stability and performance comparable to that of many wire wound resistors.

⑤ VITREOUS WIRE WOUND RESISTORS
A superior power wire wound resistor designed for high temperature service. Power ratings from 3 watts to 300 watts.

ALSO AVAILABLE BUT NOT ILLUSTRATED

Insulated Carbon Resistors, High Voltage Resistors, Coaxial Line Terminating Resistors.

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Operating in the U.S.A.

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New Products

(Continued from page 80)

A new tube fitting anchor or mounting stud to simplify support of tubing lines is offered by **Parker Appliance Co.**

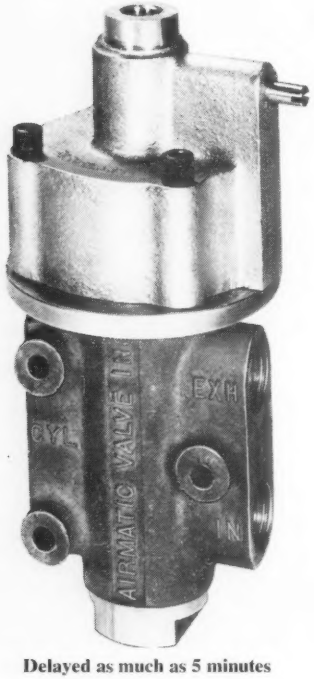
The stud, featured at the recent Instrument Show in New York, is a bolt type adapter made in both the Intrulok and Triple-lok styles. The former is the brass, flareless-type tube fitting especially suitable for instrumentation lines of either copper or plastic tubing. The latter is a flare-type fitting, made in brass, aluminum, steel or stainless steel.

The stud is used to mount a tee or cross fitting directly to a bracket or in a threaded boss. The mounting adapter is convenient for lead-off locations in banks of tubes. (212)

• • •

Delay Valve

A line of 2 way, 3 way and 4 way time delay valves is announced by **Airmatic Valves, Incorporated.**



Delayed as much as 5 minutes

The time delay valve provides delayed actuation with immediate reversal or immediate actuation and delayed reversal.

Working on a volume principle, an operating time of from 0 to 5 min. delay may be accomplished by manual preset adjustment.

Since they are pilot operated, these valves may be remotely located and controlled from a central station.

They are available in standard pipe sizes ¼ in., ⅜ in., ½ in. and ¾ in. (213)

Enclosure covers

Another instance of unobtrusive yet valuable refinements made possible, at low cost, by intelligent industrial product design is provided by new-style enclosure covers for certain types of **Square D Company Canada Ltd.** starters. Concealed under the name plate on the cover of the smart new Quik-Change Series A starter is a knockout, by means of which a push button or a selective switch can be added to the field, quickly and easily. Normally such changes involve considerable shut-down time and costly wiring. Space is also provided in the enclosure for adding four extra auxiliary contacts.

Another feature is the molded coil. Of improved design, this coil is less subject to mechanical injury, operates cooler because of more rapid heat transfer and makes for easier coil changes. (214)

• • •

Improved battery

Transport batteries made by **Exide** now have silvium alloy positive grids, a lead oxide active material known as GOX and Pormax plate separators. The weight and size of the batteries remain within commercial and military requirements.

Silvium, a patented alloy of silver, lead and other metals, gives added assurance of reserve power for a plane's electrical load. Having the highest resistance to electrolytic corrosion yet attained in lead-acid battery grid alloys, silvium is best able to withstand abuse from overcharging, a risk on long distance flights. Grid alloy durability has been increased to keep pace with the trend toward heavier generating equipment required for bigger electrical loads. In this way, silvium insures against battery failures which cause take-off delays or loss of vital reserve power for communications and controls. GOX has at least three times more surface area exposed to the electrolyte than ordinary active metals. (215)

• • •

Transducer Unit

A new transducer unit, known as Nultrax, has been developed by the electronics division of **Canadian Westinghouse.** It makes possible the measurement of linear displacement to accuracies of one part in 100,000 over its full length and can be used for applications where effective travel lengths of up to 10 ft. are involved. This range is expected to be increased in the future.

The accuracy is accomplished by converting dimensional data into precise electrical equivalents. The name is derived from the fact that the device operates by seeking or tracking a null point in a sinusoidal function.

Incorporated in either simple measuring systems or in complete positioning systems, the new unit provides the extreme accuracy necessary for the automatic control and programming of machine tools. Although particularly suitable for automatic control and programming, the new unit can be used for any operation requiring precise linear measurement.

A few typical applications in the machine tool field are: lathes, jig borers, boring mills, milling machines, grinders, drilling machines, gear cutters and other special machines. It can also be used for precision instruments such as microscopes, testing machines, gauges and comparators.

High accuracy and a repeatability greater than 20 microns makes the unit suitable for a variety of operations in the aircraft, automotive, chemical, petroleum and other industries. (216)

• • •

Vacuum Gauge

A new single meter type vacuum gauge, 0-100 microns Hg full scale, is announced by **Hastings-Raydist, Inc.**

The new instrument has a 4-in. indicating meter with a knife edge pointer for direct reading on a logarithmic mir-

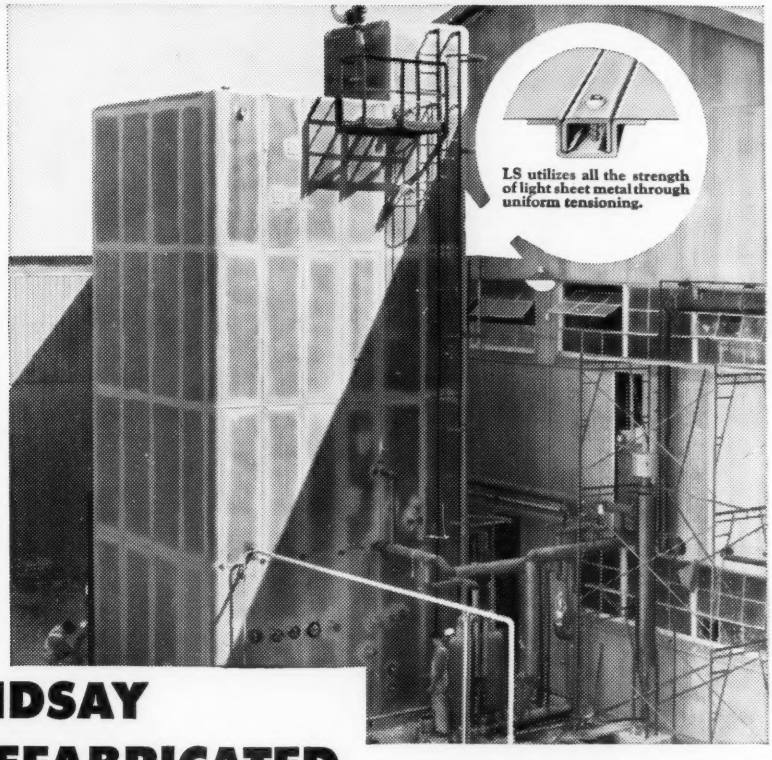
Measuring the microns

ror meter scale. Half scale on the dial face is 15 microns, providing excellent readability for low micron measurements. The instrument is highly accurate throughout the entire range.

An improved design of the gauge tube, incorporating a patented temperature compensated noble metal thermopile, provides greater sensitivity and higher accuracy in the low micron range. The noble metal thermopile is housed in a nickel plated gauge tube, thus affording freedom from outgassing, system contamination and corrosion. The gauge tube is extremely rugged, has quick response and is not damaged by release to atmospheric or positive pressures. The gauge tube need not be removed during cleaning of the vacuum system.

The instrument operates on 115 volt ac and includes an internal voltage regulator to eliminate any effect from line voltage variations. (217)

If You Need Metal Enclosures Save Time and Tooling with–

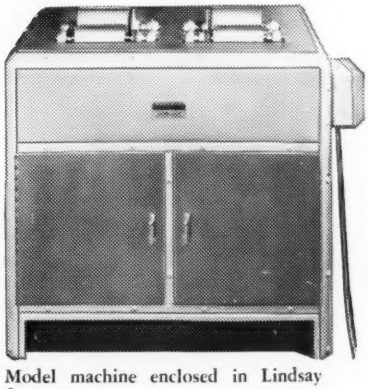


LINDSAY PREFABRICATED ASSEMBLIES

A Lindsay Prefabricated Assembly for the housing on a 38 ft high "Cold Box." The lower LS panels withstand a pressure of about 500 pounds per square foot.

Lindsay prefabricated assemblies are tailored to your exact needs from die-formed, standardized Lindsay Structure components . . . fabricated in 78,085 panel sizes . . . available in mild steel, stainless steel, copper, or aluminum . . . shipped k/d for quick assembly with standard tools. LS shipments can be scheduled to keep pace with your production needs. Fast service on pilot units.

Put this versatile, prefabricated structure to work for you . . . simplify designing, save on dies and tooling, conserve skilled man power. Write, today, for descriptive folder or send single-line drawing for prompt cost estimate.



Model machine enclosed in Lindsay Structure.

LINDSAY-WILSON LIMITED
1466 Lake Shore Rd., Long Branch, Ont.
Toronto 14

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Patents

Some new ideas win protection in Canada

A DIAL AND POINTER, designed to assist motorists to park their cars, is covered by Canadian Patent 523,853, issued April 17, 1956 to Julius C. Basso of Owosso, Mich., who invented the device. The dial is designed to be mounted on the shelf above the dashboard of the car and the pointer is set at an angle that is found by experience to give good results when backing a particular car into the parking space. An angle of 35 deg is suggested by the inventor as generally suitable.

When the driver wants to park his car, he drives up beside the vehicle behind which he is to park, cuts his wheel sharply and backs up until the pointer is parallel to the roadway. The wheels are then turned sharply in the other direction and the parking operation completed.

• • •

Glass building block

A GLASS BUILDING block that automatically prevents mortar from adhering to the transparent surfaces is covered by Canadian Patent 524,868, issued on May 8, 1956 to Pittsburgh Corning Corporation of Pittsburgh. Invented by Dominic D'Eustachio, of Port Allegany, Pa., the building block has its opposite exterior faces covered with a transparent organopolysiloxane resinous film. Only the marginal edge surfaces between the exterior faces are free from the film and thus these are the only surfaces to which mortar will bond.

• • •

Vacuum tube electrode

A NEW KIND OF electrode for vacuum tubes has been patented by Westinghouse Electric Corporation in Canada Patent 519,064, reissued November 29, 1955.

Invented by John H. Findley of Upper Montclair, N.J., and Dewey D. Knowles of Lowman, N.Y., the new electrode is said to have the low secondary emission ratio of powdered carbon without suffering from the usual disadvantages of this material—its inability to stick to the base metal tightly enough.

The electrode has a supporting base metal of molybdenum or tantalum having a smooth surface. On this a layer of fine particles of tantalum powder is painted or sprayed, and then fired or sintered so that the powder adheres firmly to the base metal. This layer of small particles of tantalum is graphitized by heating in a hydrogen atmosphere containing benzene vapor.

The patented structure has the advantage that electrons emitted from the region between the tantalum particles are likely to strike another particle of graphite-coated tantalum powder instead of moving out into the open space beyond thus accounting for the low secondary emission ratio.

• • •

Heat-insulating material

A NEW INSULATED fabric that is suitable for heat-insulating gloves and other articles of protective clothing has been patented by Johns-Manville Corporation of New York. Invented by Jesse L Tucker, of North Plainfield, New Jersey, and covered by Canadian Patent 524,842, issued May 8, 1956, the fabric consists of outer and inner laminations of flexible asbestos cloth, with an intermediate lamination of metal foil. Between the metal foil and the asbestos there is a woolen-fabric liner.

• • •

For the land of nod

A CONVERTIBLE MATTRESS for either twin or double bed use is covered by Canadian Patent 524,716, issued May 8, 1956 to the inventor Dwight A. Griggs, of Braintree, Mass. The mattress is composed of two standard twin-bed size mattresses that have well-defined beading around their edges. Under the upper edge beading on one side of each of the mattresses is one of the two sections of a standard slide fastener. To make a single mattress of double-bed size, the two twin-bed mattresses are placed side by side and zipped together along the upper edges.

• • •

Flanges for tubes

A METHOD FOR flanging thin-walled metal tubing that uses a helical coil of strip metal was patented in Canada on December 13, 1955 by the inventor, James J. Kraus, of Neenah, Wis.

According to Patent No. 519,332, the metal strip is coiled edgewise in the plane of the strip to form a tight helix, and the helix is applied to the end of the tube so that the end turn of the helix can be progressively attached to the end of the tubing.

When the length of strip required to form a continuous flange is determined, it is cut from the helix, the extremities of the strip aligned with each other and joined, and the remainder of the length of the strip attached to the end of the tube.

• • •

Canadian Patent Laws

THE PATENT LAWS of Canada do not slavishly follow those of the U. S., stated John H. Graham of Esso Research recently. Rather, they are set in a somewhat similar mold. As in all other countries which are considered to follow a Master system and are classified by their common features of prosecution and procedural requirements, the parallel regulations of Canada and the U. S. A. become traps for the unwary if careful attention to the deviations from that parallel is not exercised.

With the Royal Commission currently investigating all phases of Canadian industrial property rights, many investigators are scrutinizing the law of patents and all the controlling regulations with respect thereto, to determine whether radical changes are needed. It has been proposed variously to orient those laws more closely to those of the U. S. or to those of Great Britain or to leave the Canadian patent laws as they are.

There are, apparently, advocates for each of these three propositions. Those who cleave to the idea that Canadian patent law should be most closely patterned on the U. S. patent statutes, usually contend that the present laws of the two countries are practically equivalent. Those who advocate the British system advance the theory that, whatever the form of statute, the philosophy behind the patent law is that of the English Statute of Monopolies of 1624 and since Canadian patent jurisprudence leans heavily on British decisions and interpretations, the laws should be more closely allied.

The third proposition, namely, whether Canadian law should be left in its present form, warrants a careful analysis. Contrary to the opinion of many, Canadian patent law is in its major provisions by no means parallel in force, effect or scope to that of the U. S. Nor is there in any way a similar direct parallel to comparable British patent provisions. It assumes a position intermediate to the two patent statutes, having similarity in some sections, equivalency in others, and complete differences in still other regulations. Thus, the Canadian Patent Law of today, while recognized as a hybrid of the Statutes of Great Britain and the U. S. A. is, in essence, autonomous. Like many mutations, it has established its own environment and while turning occasionally to each parent for that guidance concomitant of a greater experience, manages to carry on a separate existence.

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LET OUR READER'S SERVICE department help you with full information about any New Products or Literature mentioned in this issue of **Design Engineering.**

- Following each announcement on the New Products and File pages are identification numbers in brackets.

- This is all you have to do: Circle the corresponding numbers of any items that especially interests you on the postage-free tear-out card on this page. Then mail the card.

- Quickly the Reader's Service department will be working for you. All available information will be mailed at once to help you build a useful up-to-the-minute library from the technical booklets, pamphlets and pictures prepared for your use.

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This is a Production Manager

(in a desperate situation)

keeping the line rolling

(on a rush order)

by trying to bridge the gap

(requiring special components)

a dependable service on forgings could close

(from Wallaceburg, of course)

If the situation demands fast service on components it's time to call in the man from Wallaceburg. For fifty years we've been supplying industry with component parts—at the right time and at the right price.

Now, with Wallaceburg-Singer Limited producing cored brass forgings we've more than ever to offer. Call us for Cored Brass Forgings, Die-Castings in zinc and aluminum, Machined Sand Castings in brass and bronze, and Automatic Screw Machine Products in brass, steel and aluminum.

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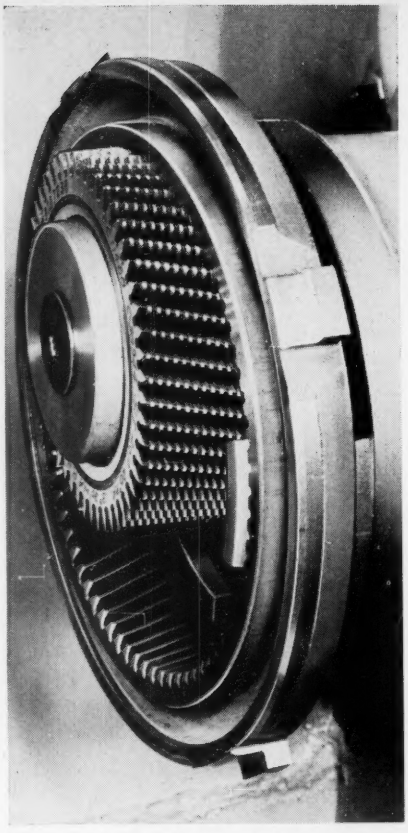
Design news in pictures

The heart of the matter

An Atomics International physicist checks the core of a nuclear reactor built by his company for Chicago's Armour Research Foundation. This is the first built for private industrial research. 'Atom-splitting' takes place in this stainless steel core. Output of reactor is 50,000 watts. (218)

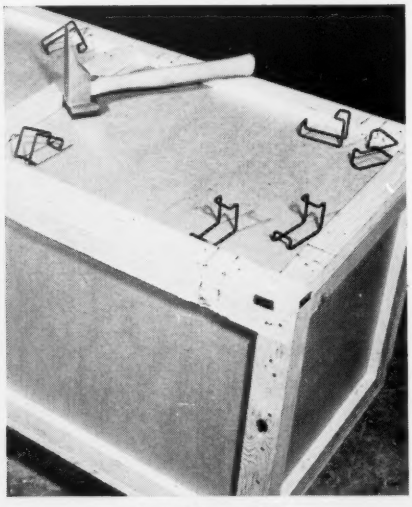


A shaver shows its teeth

Improved internal shaver hails from National Broach and Machine Co. Ease of use merely requires hanging the gear on the cutter, button pressing and removal. (219)

"Noteworthy and fresh approach . . ."

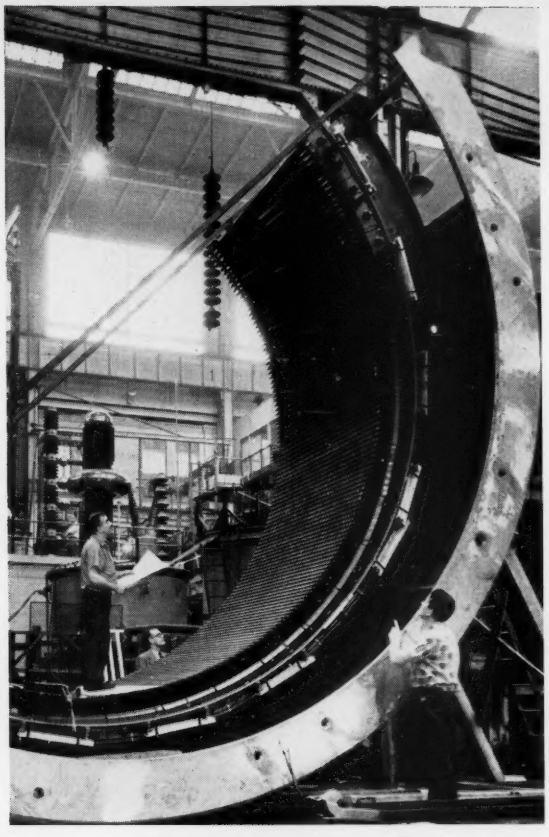
One of three designs to capture 1956 awards from the Industrial Designers Institute was William E. Clements' new-type electric thermometer for the nursing and medical professions. Producer of the "Therma Meter" is the Medical Research Institute Inc., Cincinnati. (220)



For buttoning-up boxes

New idea in fasteners is North American Aviation "Klimp." These spring steel clips have 30 times the holding power of nails and the boxes can be used over again. (221)

Some modern designs making news today



Changeover for the big stuff

A giant stator for a power generator frames million volt lightning test equipment at Canadian Westinghouse. The company is rebuilding several for 60 cycle operation and they return to duty at No. 1 station Niagara Falls. (222)

Passengers in their pod

Designed to eliminate the costly ground run of jet craft and the hazard of engine blast is Clark Equipment's new Mobile-Cruiser. It boards passengers at the gate, drives to the plane and raises them to the airliner door. (223)

House you can take with you

A Welsh firm, Elliott Equipment, recently developed a new inflatable hut. The firm's chief promotion man packs one in the trunk of his tiny car, inflates it with a small compressor and drives in out of the British rains. (224)

The coin and silver paper trick

New to Avro Aircraft at Malton is this hydraulic press. A 15,000 ton upward pressure stamps impressions through sheet metal into the giant rubber pad made by Goodyear. Siempelkamp of Germany designed and built press. (225)

Letters

Readers' viewpoints . . .

● We are interested in receiving one copy of the article, "How Best You Can Heat Treat Aluminum" by J. F. Whiting, from the March, 1956 issue of your periodical, Design Engineering.

Please advise us if you can supply either tear sheets of the article or a back-issue of the periodical, quoting prices.

Thank you.

MRS. JETTA MARSHALL
Librarian
California *Hunter Engineering Co.*

A copy of the March issue was sent free of charge—Ed.

Textbook wanted

● It would be highly appreciated if you could arrange for C.O.D. delivery of one volume of "Turboblowers" by A. J. Stepanoff, Ph.D., as announced in Design Engineering.

It should arrive in Delhi after the 10th of July, as I will be on holidays until then.

Thank you.

ERIC W. SULEK
P. Eng.
Delhi, Ont.

Arrangements have been made with the publishers to do this—Ed.

Fuel injection

● Mr. Elliott Street is to be congratulated on his most interesting and informative article on gasoline injection.

May I add some notes from my own experience. My interest in gasoline injection has been in its use in bus engines. In a well-run fleet, these engines will consume 25 times their own first cost in fuel, in their useful life of one million miles. Thus, any device that promises even a minor saving in fuel is well worth considering.

We found that gasoline injection improved the full-load economy by 3% on the dynamometer, compared to that of the best carburetor. The road-load economy was improved by as much as 8% on service test. The difference is probably made up of saving in fuel on the over-run (coasting), since, with fuel injection, the fuel supply is entirely cut off until the engine speed has fallen to idling speed—an important point.

We found that it was more difficult to develop a satisfactory control device than a satisfactory pump. The gasoline injection project was abandoned because the bus market was by then turning exclusively to diesel engines.

Finally, may I add that I believe the German Air Force went into War II with gasoline injection as standard equipment. My congratulations to Mr. Street for his excellent article.

P. E. BIGGAR
Toronto

Industrial design

● I would like to obtain information about any good course in general industrial design. This would have to be either extension or correspondence.

If you have any data on organizations carrying this type of course, or possible persons who could direct me, I would certainly be grateful for your help.

F. A. SEEDHOUSE
Engineering Dept.,
Oshawa *Field Aviation*

To the best of our knowledge there is only one such course in Canada. This is at the Ontario College of Art, under the direction of Charles E. Wetmore—Ed.

Creativity movement

● Would you please arrange to pass on my name to the organizers of the creative engineering movement, as an interested party.

My own approach is concerned with the development of the notion that materials, particularly metallic, are only acceptable from the one source and conversely how the supply and fabrication from this one source affects individual thinking.

ERIC C. BELL
Metallurgist
Malton, Ont. *Avro Aircraft Ltd.*

● I should be interested to receive any further information on creativity in industry.

Yours very truly,

G. C. HEATON
P. Eng.
Toronto *Ferranti Electric Ltd.*

These names have been passed on to the chairman of the new society so that they may be kept well informed. —Ed.

Interest in new product

● Kindly forward me at your earliest convenience leaflet from Propellair, concerning direct connected fans, as on page 68 of the July, 1956 issue of Design Engineering.

S. A. RODWIN
Refrigerator Engineer
Toronto *Major Appliances, C.G.E.*

● On Page 62, of the July issue of Design Engineering, a picture was shown of a Case-Maul toggle clamp. I am interested in more information on this but cannot find it in this issue.

Would you kindly advise me of the supplier of this clamp.

JOHN H. BECKER
P. Eng.
Propane Containers of Canada Limited

Advertising index — September

Editorial

Tell us—what do you think?

DESIGN ENGINEERING, while still an infant, and a healthy one, is no longer a baby. This issue marks the completion of a year and a half of publication — time perhaps to take a backward glance over those 18 months, restate the magazine's original aims and pause to assess our achievement.

DESIGN ENGINEERING was introduced in April of last year to fill the large gap in the Canadian publications field for a magazine catering to the design engineer and his increasing importance in a country of such rapid economic growth. You, as a design engineer, must be forever on the alert for the latest and best materials, methods, finishes and components. To do this is a hard task if, to keep up to date, you have to combine the functions of design engineering with those of news scouting and a heavy program of reading and interviewing.

That's where we come in. As a magazine aimed directly at the design engineer we are in a good position to get the information most likely to keep you in step and in front. In fact we act as both gatherers and originators of this material for final clearance to you in a concise and readable form.

Just how do we rate for achievement? We think we score high but . . . are we really in a position to make the assessment?

There's an old and well-known saying that the proof of the pudding is in the eating. We, the editors, are just the cooks. It is you, the design engineers, who monthly have to approve the value of the product. What then, is your opinion? Since the best way to find the answer to a question is first to ask it, that's what we'll do.

We extend to you in this editorial an open invitation to tell us just how **you** think we've been doing as far as **you** are concerned. Tell us, if you will, what you have liked and disliked and what trends you'll be looking for in DESIGN ENGINEERING.

Obviously, we can't please everyone but why not take up your critic's pen and send us a "no holds barred" letter?

RSVP

. . . . *filled here*

It takes tons and tons of materials to fill the prescriptions that give strength and stamina to the steel you use

THE STEEL that's everywhere—in your automobile, in trains, machines, and buildings—is stronger and more enduring because it has been treated with special 'vitamins and tonics.'

STEEL GETS ITS VITAMINS from the industry's 'drugstores'—the plants where alloying metals are made. Here, prescriptions usually call for ingredients by the ton. Their huge 'mixing bowls' are white-hot electric arc furnaces, in which temperatures reach over 3,500 degrees Fahrenheit.

These alloying metals are refined and concentrated forms of both rare and common metals. Among them are manganese, silicon, chromium, boron, tungsten, columbium, and vanadium. Individually, or together, they give steel durability, toughness, hardness, rust and corrosion resistance, and other special qualities. Chromium, for example, is the secret of making steel stainless.

VARYING COMBINATIONS of these and other alloys are added to every ton of molten steel produced today. Without them we wouldn't have the hundreds of different kinds of steel that do so much for all of us in so many ways.

MORE THAN 50 ALLOYS—The people of Union Carbide pioneered in the development and production of alloying metals. They make available more than 50 different alloys for steel and other metals that go into products that serve you.

FREE: *Learn how* ALLOYS, CARBON PRODUCTS, CHEMICALS, GASES, *and* PLASTICS *improve many things that you use. Ask for 'Man-Made Miracles' booklet D.E.-4.*

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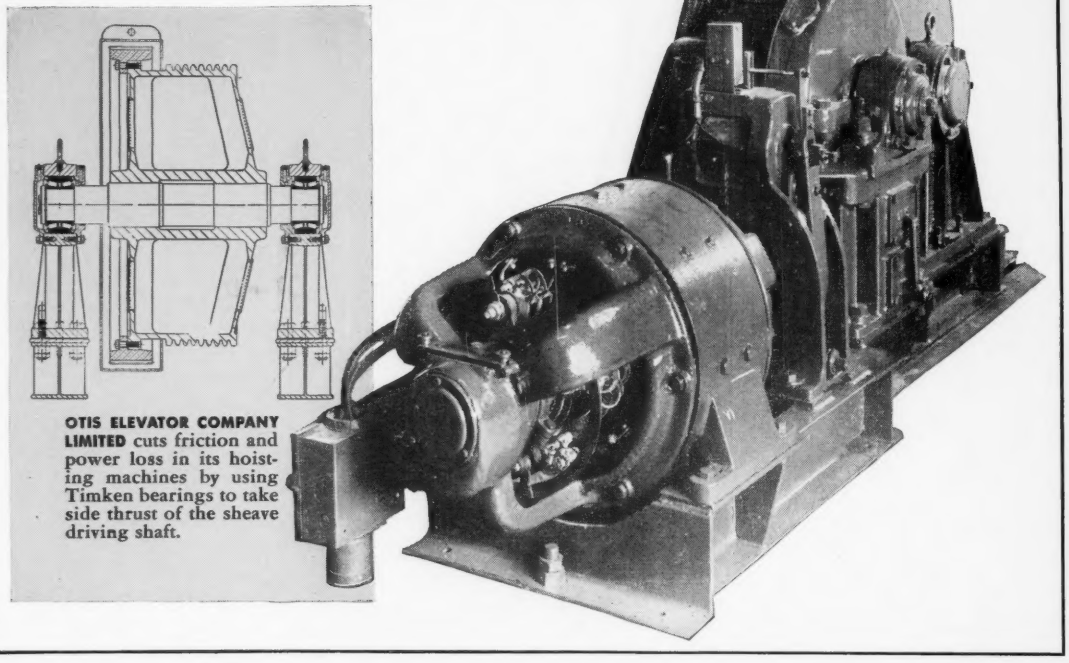


OTIS ELEVATOR COMPANY LIMITED cuts friction and power loss in its hoisting machines by using Timken bearings to take side thrust of the sheave driving shaft.

How TIMKEN bearings cut friction and power losses in Otis Elevator hoisting machines

ENGINEERS at Otis Elevator Company Limited had the problem of side thrust in designing their hoisting machines. Especially on the driving sheave shaft in the larger models. Unless this thrust was handled efficiently, there would be high friction and resulting high power loss.

Otis engineers solved the problem by equipping these hoisting machines with Timken tapered roller bearings. And they get the following results:

1. Less friction loss and therefore less power loss.
2. Elimination of the need for a separate side thrust unit on the sheave shaft.
3. Easy adjustment of wear between worm and gear by simply lowering the pillow block which retains the roller bearing, instead of having to rebabbitt the bearing.
4. Reduction of shutdown time.

Timken bearings can deliver these advantages because they can take thrust as well as radial loads, in any combination. And full line contact between rollers and races gives Timken bearings extra load-carrying capacity. In addition, Timken bearings practically eliminate friction with their true rolling motion. The result: Otis hoisting machines operate smoothly, easily.

Other advantages are low maintenance and lubrication costs. Timken bearings hold housings and shafts concentric, making closures more effective. Lubricant stays in—dirt stays out.

It's easy to understand why Otis, like so many other manufacturers of fine machinery, uses Timken bearings. They last longer, for the life of the machines, make machines run better, cost little to maintain. Whether you buy or build machinery, it will pay you to see that it is equipped with Timken bearings. The Timken Roller Bearing Company, Canton 6, Ohio. U.S.A. Cable: "TIMROSCO". **CANADIAN PLANT:** St. Thomas, Ontario.

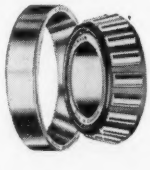
This symbol on a product means its bearings are the best.

TIMKEN *Made in* **CANADA**

TRADE-MARK REG. IN CANADA AND U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

FOR CANADIAN INDUSTRY



NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◎ AND THRUST ←◎→ LOADS OR ANY COMBINATION ✳